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A STUDY OF STATE REGULATION.

Elsewhere in our columns is given a summary of the work of the Massachusetts Gas and Electric Light Commission on the adjudication of street-lighting matters during the past decade. Massachusetts is to a very large extent in the curious situation of having delegated many important matters of government to commissions. Not the least important of these is the Gas and Electric Light Commission, which has, in theory at least, large authority in regulating rates as well as in standing guard over the capitalization of corporations engaged in gas and electric business. Its decisions constitute a body of precedent comparable in importance to decisions of the courts. Such a body has large potential powers for good or harm and it is only fair to the Massachusetts commissioners to say that they have a highly conservative record, unmarked by anything sensational and free from any imputation of socialistic tendencies. They err, if at all, on the side of caution and conservatism. The cases cited in this issue were not in their results of any considerable importance either to those concerned or to the municipalities or persons who started the proceedings. The changes in price ordered by the commission have rarely been large enough to be burdensome to the one party or satisfactory to the other. The decisions, however, touch on some extremely interesting and important points of policy and are worth more than a casual glance.

Perhaps the most interesting on the list of the decisions is the Fitchburg case ten years ago, and while the ultimate result was merely a reduction in the price of the street arc lighting of $10 per lamp per year, some vital points in the relations between capitalization and permissible prices were touched upon. In this instance the public service company operated both the gas and the electric business. In the case of the former under a conservative administration considerable sums from the income had been devoted to the improvement and development of the plant and its thorough up-keep. The board therefore held that under these circumstances the gas plant had attained a high value in respect to the capital issued upon it, and that upon such issue of capital a higher return than would be otherwise permissible might be allowed without prejudice to the public interest. With respect to the electric plant it appeared that the company, prior to going into the electric business, having earned and declared dividends of 10 per cent per year, these dividends were continued without interruption upon the entire capital invested in the electric plant, which had naturally come into a condition to demand thorough reconstruction in order to furnish satisfactory public service. On behalf of this electric plant, therefore, the board found that only a moderate dividend was justifiable. It is hard to overestimate the beneficial effect of this decision were it rigorously carried into effect. Obviously capital invested in a public service corporation has a right to a fair and reasonable return upon the investment, whatever that may be, under current and local conditions. It is not entitled to the same rate upon fictitious capitalization; on the other hand, it should certainly not suffer by having its rate reduced below the point that will take

care of maintenance and depreciation in addition to the reasonable net return. It has been the too frequent habit of such corporations to let up-keep and depreciation slide comfortably along until there arrives a day of reckoning in which something has to be done. Then there is usually an issue of securities to cover the funds which have been diverted from up-keep and depreciation to dividends for the prior term of years. The Fitchburg decision indicates in unmistakable terms that, while a relatively high rate of dividends may be allowed on a conservative investment that is kept up to its full value by conservative treatment, overcapitalization will not be encouraged in any form. Overcapitalization is an extremely hard thing to prevent since there are many ways of accomplishing the end. but if the commissioners hold rigorously to the principles laid down in this decision the way of the transgressor is likely to be hard in Massachusetts.

Another curious case came up in the Newton petition of the next year and in the Worcester petition of the same year. In the former case the street-lighting contract was found by the commission to have been taken at a figure which gave a small rate of return from the investment of the street-lighting part of the business upon the interest paid by the company upon its loans. In other words, the business was being taken at a little less than conservatively reckoned cost, so that the private consumers had to bear more than their share of the burden of the investment charge. In the Worcester case the city attempted to secure street lighting at cost, which involved the same shifting of the burden upon the private consumer. To this attitude the commission emphatically objected, holding that the rates for municipal use should not be made so low as to impose undue burden upon the private consumers. This sets out a principle which has often been violated upon a small scale. There not infrequently appears a tendency on the part of the municipalities to get some of their lighting for little or nothing in order to decrease the apparent cost of this lighting, when the inevitable result must be to transfer this saving made by the city to the private consumers in the form of extra costs. In effect, the commission held that the municipality should have the rights of any large consumer, but no more.

Even more interesting was one of the other cases mentioned, that of a petition from the town of Winchester alleging discrimination on the ground that the operating company had offered a neighboring town a large discount for a long-term contract, while Winchester, being unwilling to make a contract at the time for more than one year, was charged a higher rate. The board, after considering the matter, ruled that inasmuch as Winchester could secure the same discount if it chose to execute the contract for a longer term, thereby rendering the investment of the supply company a more permanent one, there was no unlawful discrimination nor any justification for ordering a reduction in price on this ground. The cases here mentioned are only a few of those cited, but they are sufficient to show the importance of a well-organized commission in adjudicating the difficult questions that are constantly arising between municipalities and public service corporations. The proceedings of the commission are comparatively brief, involve no long-drawn-out litigation, and the decisions take effect promptly. The authority entrusted to the Massachusetts commission is very great, dangerously great perhaps under conditions which might arise elsewhere, but on the whole the system has worked well and the decisions have very commonly been followed by an equal amount of growling from both sides, which is in general fairly good evidence of substantial justice.

WAVE-METERS IN WIRELESS TELEGRAPHY.

In wireless telegraphy use is made of electromagnetic waves in the ether. These waves are not directly appreciated by any of our senses, although if they were short enough to fall between the limits of 0.4 and 0.8 micron we have reason to believe that we could see them. The waves used in wireless telegraphy, of lengths, say, from a dekameter to a myriameter, must have been produced in the ether occasionally owing to natural causes, but were never detected until about twenty years ago, and now we are sometimes all too conscious of an amateur excess. This recent remarkable ignorance of circumambient activities should make us reticent in formulating the opinion that we understand nearly all of the universe. We may still cheerfully expect to learn more. We can see, feel and hear ocean waves. Our primary concepts concerning waves are mainly derived from sense memories of water waves, either on the ocean or in rivers and canals. We can hear sound waves and experiment with them in the laboratory. We can, in a certain sense, see short electromagnetic waves, but our notions are still crude as to the nature and true inwardness of a long electromagnetic wave.

It is known that when the ether is disturbed in a certain unknown way that we call electric there necessarily occurs at the same time a corresponding cross-disturbance which we call magnetic. A wireless telegraph semi-wave we can conceive of best as running over the land or sea, like a gigantic fence, with electric forces up and down, like the perpendiculars of the fence, and with magnetic forces in level courses, like the horizontal bars of the fence. If the wave would only stand still instead of rushing away at the speed of light we should expect to find a delicately suspended charged pith ball pulled in the up-and-down direction, and a delicately suspended horizontal compass needle aligned along the wave front, when subjected to the forces in the stationary wave. In the succeeding semi-wave the directions of these electric and magnetic forces would be reversed. The most important structural feature of the wave would naturally be its distance from crest to crest of like sign; or, as we call it, the wave-length. If the frequency of oscillation at the wireless sending station is doubled, the lengths of the emitted waves will be halved, so that if we know either the frequency or the wave-length of a simple sinusoidal wave-train we may infer the other immediately. In tuning stations one to another a knowledge of the length of the waves and of the natural frequency of the apparatus is obviously of great assistance. According to government regulations, all regular wireless stations have been directed to emit and conform to a wave-length of 300 meters, but to direct is easier than to comply.

The article by Mr. George Seibt in this issue discusses the history of wave-meter development. He intimates that, whereas the development in that art has been largely due to German engineers and physicists, attention in the United States has been more or less confined to purely commercial affairs. While we gladly admit that a large contribution to this work of wave-metering has come from Germany, nevertheless a very considerable share has also been taken by England, France, Italy,

Switzerland and the United States, not to mention other countries, so that a careful enquiry will reveal no need for apology among us on this score. It is true that there has been much exploitation and promotion of wireless telegraph systems on this side of the Atlantic for stock-market purposes, but the progress of a science and its art are not to be judged adequately from a sole consideration of stock-market journalism. There can be little doubt that technical progress in wireless-telegraph engineering will demand and involve refinements in wave measurements and wave-meters. The history of this art when it comes to be written, in full and in detail, will also make very interesting technical literature.

PRESENT POSSIBILITIES OF EMPLOYING UNDERGROUND CABLES FOR TENSIONS ABOVE 25 KILOVOLTS.

In this country practically all of our high-tension systems working at pressures of 25 kilovolts and over are overhead systems. It is true that there are high-tension distributing networks in a few cities, but, as a rule, the e.m.fs. do not exceed the tension of 10 kilovolts. Again, most high-tension transmission lines are carried overhead through open country or sparsely settled districts. The problem of carrying an overhead 100-kilovolt transmission line through a city of large size is manifestly very difficult. In practice it would be desirable either to go around and avoid the city, or to carry the line underground at a reduced pressure. The progress of long-distance energy transmission is thus clearly more hampered in thickly settled districts than in open, unsettled country. It is harder to introduce into more crowded Europe than into the less crowded eastern United States, and harder in the Eastern than in the Western States. If, however, underground cables were just as cheap and reliable as overhead wires the difficulties in approaching and traversing large cities would be removed.

An article on this subject by M. J. Grosselin has recently appeared in *La Revue Electrique*, in which the impossibility of using cables for very high tensions is called in question. The principal difficulties are the high first cost, the large charging current, and the delay and expense of repairs. It is contended that it is perfectly possible at present, from the technical standpoint, to establish long-distance underground transmission e.m.fs. up to 50 kilovolts, using armored, twisted cables, and up to 67 kilovolts in single-conductor lead-covered cables. Much difference of opinion is likely to arise over some of the expedients offered in the article. There can be no question, however, of the desirability of utilizing underground cables at high tensions whenever it is economical to do so. The progress of high-tension cable manufacture should be aided and accelerated. At the same time, the future of long-distance energy transmission is likely to reside in overhead conductors carrying alternating currents. No greater incentive could be given to the development of high-tension direct-current transmission systems than the urgent necessity of placing the conductors underground.

With a pair of underground direct-current conductors operated at, say, 100 kilovolts between them, it would not be necessary to raise the normal pressure in each main above 50 kilovolts with respect to the ground, whereas with the alternating-current system that pressure must be raised to over 70 kilovolts on the crest of each wave. Again, with direct-current transmission the charging current would normally be nil and the dielectric loss insignificant; whereas with alternating-current transmission the charging current might be very expensive to supply and the dielectric hysteretic loss might easily exceed the copper loss. It is quite conceivable that when it becomes necessary to place a very high pressure transmission system underground we shall develop alternating-current generators supplying energy to step-up transformers to operate rectifiers that shall deliver a large block of power, by underground mains, in direct-current form, with de-rectifiers at the distant end feeding energy to step-down transformers and a distribution network.

STREET-LIGHTING ECONOMY.

While we appreciate to the full the progress in Continental Europe with respect to the material and methods of street lighting, it is curious to note some of the strenuous efforts there made to secure economy. Here all-night and every-night lighting is the rule, while on the Continent a very large part of the illumination is shut off at midnight. Only recently the Paris chief of police has thrown all his influence toward increasing the amount of street lighting, and particularly continuing it through the night instead of extinguishing a large part of it at midnight. The police value of street lighting increases after midnight, since after that hour in the nearly deserted streets there is a freer opportunity for crime. Certainly the large European cities are on the whole no more orderly than our own. It is to be hoped, therefore, that American practice can return the benefits it has received from European practice by throwing its influence in the direction of all-night lighting.

The queerest economy, however, that has ever fallen under our notice is a scheme of nickel-in-the-slot public lighting recently described in a Berlin paper. In the half mile between two small European towns nine incandescent lamps are installed, and the thrifty local authorities, concluding that nocturnal wayfarers should be penalized, extinguish the lights at 10 p. m. They thoughtfully provide, however, on the lamp-post at each end of the lighting a prepayment meter which will respond to a 10-pfennig piece by turning on the lights for twelve minutes, a time that seems all too short for the gentleman who is pursuing a vacillating and circuitous path between the termini, however adequate it may be for those hurrying home sober. It would strike one as a wise piece of paternalism to provide at least one intermediate meter for continuing the good work. The scheme is certainly uniquely whimsical and reminds one of the terms in which Berlioz once stigmatized the assignment of both bass drum and cymbals to the same performer as "a poor and pitiful economy, fit only for those who travel about the country with bears." Joking aside, the Continent has much to learn of us regarding the value of continuity of lighting service. Municipal economy is a virtue which can be practised too much. We too frequently err here in insufficient lighting, but we do not in most cities extinguish the street lights at just about the time that the burglar starts out on his daily work. Improved lighting, whenever installed in American cities, has been followed by improved conditions from the police standpoint, and it will be very interesting to watch the effect if the street lighting of Paris, as is now urged, should be extended through the night in accordance with American practice. It is somewhat inconsistent that turning off lights at midnight should be the practice in a city where a century and a half ago the moonlight schedule was lampooned and laughed out of existence.

Chicago Meeting of the American Electrochemical Society.

At the eighteenth general meeting of the American Electrochemical Society, to be held in Chicago, on Oct. 13, 14 and 15, the following papers will be read and discussed: *Method for Determining Thermal Conductivity,* by Mr. Carl Hering; *The Electric Furnace and Its Application,* by Mr. Marcus Ruthenburg; *Electrolytic Method of Producing Metals,* by Mr. John W. Beckman; *Reduction of Tin Dross in the Electric Furnace,* by Mr. R. S. Wile; *Notes on Tribo-Luminescence,* by Mr. W. S. Andrews; *The Proximate Constituents of the Chemical Elements with Reference to Radioactivity and Electrons,* by Dr. Gustavus D. Hinrichs; *Electrochemical Preparation of Calcium,* by Prof. A. R. Johnson; *Efficiency in the Electrolytic Preparation of Calcium,* by Messrs Francis C. Frary. Henry R. Bicknell and Carl A. Tronson; *Electrochemistry of Polonium and other Radioactive Elements,* by Prof. A. R. Johnson; *The Present Status of Ozone,* by Mr. R. D. Small; *The Evolution of the Lead Storage Battery,* by Mr. Pedro G. Salom; *A New Secondary Cell,* by Mr. W. S. Block; *The Self-Discharge of Plante and Faure Storage Batteries,* by Messrs. O. W. Brown and W. G. Bowers; *Corrosion of Metallic Food Containers—Causes and Prevention,* by Dr. Edward Gudeman; *Electrolytic Corrosion of Various Metallic Anodes in a Liquid Ammonia Solution, Ammonium Trinitride,* by Messrs. A. W. Brown, M. E. Holmes and J. S. King, Jr.; *Electrolysis of Solutions of Ammonium Trinitride and of Potassium Amide in Liquid Ammonia,* by Messrs. A. W. Brown and M. E. Holmes; *The Electrolysis of Some Cyanides,* by Messrs. H. E. Patten and W. R. Mott; *Application of Electrostatic Separation to Ore Dressing,* by Mr. F. S. MacGregor; *The Isolation of an Ion and a Precision Measurement of Its Charge,* by Prof. Robert A. Milliken; *Phenomenon of Crystallization Through Membranes,* by Dr. J. H. Walton, Jr.; *The Relative Basicity of the Metals as Shown by Their Power to Replace One Another in Chemical Compounds,* by Dr. L. Kahlenberg; *The Effect of Water in Causing Chemical Reactions,* by Dr. David Klein; *The Physical and Magnetic Hardness of Some Electrolytic Iron Alloys,* by Mr. James Aston. The meetings will be held in the Congress Hotel, where the society will maintain headquarters, and at the University of Chicago.

Visits will be made to the Fisk Street generating station and the Market Street transformer and storage-battery station of the Commonwealth Edison Company; the Hawthorne plant of the Western Electric Company; the factory of the Automatic Electric Company; the stock yards and packing plants of Swift & Company, Armour & Company and Morris & Company; the South Chicago works of the Illinois Steel Company; the Gary plant of the Indiana Steel Company; the stores of Sears, Roebuck & Company; the Washington and Franklin streets exchange of the Chicago Telephone Company; the Lockport generating station and the drainage canal; the Field Columbian Museum.

Special entertainment for the ladies, including a visit to Hull House, Marshall Field's store, the Art Institute, etc., will be provided. On Friday evening there will be a subscription dinner at the Congress Hotel to which the ladies are particularly invited. On Saturday noon there will be a luncheon at the University of Chicago Commons, which ladies as well as gentlemen are expected to attend.

Convention of the Electric Vehicle Association of America.

It has been decided to hold the first annual convention of the Electric Vehicle Association of America in the Concert Hall at Madison Square Garden, New York City, on Oct. 18.

The convention committee, under the direction of Mr. Arthur Williams, chairman, is actively engaged in preparing a very interesting and practical program, and it is intended to have ten able writers on the subject of electric vehicles present papers. An electric luncheon will be served at the end of the morning session, and there will be a subscription dinner in the evening, after which guests and delegates will be invited to attend the Edison smoker. Invitations are being extended to everybody connected with or interested in the electric vehicle industry, especially central station men. A large number of electric vehicle manufacturers have arranged for exhibits at the New York Electrical Show, Oct. 10 to 20, and the convention, coming as it does on one of the days of the show, it is hoped, will offer an opportunity for the electric vehicle men and their friends to mingle to advantage.

N. E. L. A. Uniform System of Accounts.

The National Electric Light Association is sending to class A member companies bound volumes of the standard classification of construction and operating accounts. Accompanying each volume is a letter from Mr. John L. Bailey, Baltimore, chairman of the Committee on a Uniform System of Accounting, which urges the adoption of the classification by all companies at an early date. Mr. Bailey says:

"The present tendency is toward commission supervision for public utilities, and it is thought that the general adoption of this system will influence future commissions to accept it in place of the burdensome systems that may be adopted if no general uniformity exists."

The committee has under consideration the creation of a statistical department, to which a synopsis of monthly or annual reports could be forwarded for tabulation and distribution to member companies adopting the system. Names of companies need not be disclosed in the distribution of the statistics, but it is essential that the kind and cost of fuel be given together with other information as to the cost of production.

The entire list of member companies would be divided into three or four divisions ,depending on the number of sub-accounts used by each company. Tabulations could then be made to show for each division the comparative receipts per capita and costs per kw-hour of fuel, labor and other items. Later the scope of the statistical department might be extended so as to keep member companies advised as to franchise matters, city contracts, rates, etc.

The committee asks for information as to the extent of the adoption of its classification and the support of the statistical department.

Additions to Electrical Faculty at Purdue University.

The instructional staff of the school of electrical engineering of Purdue University, Lafayette, Ind., has been increased by several important additions, made with the opening of the present school year, the new members coming directly from the commercial fields of the engineering subjects with which their university work will deal. Prof. Phillip S. Biegler, assistant electrical engineer of the Washington Power Company, Spokane, Wash., has been secured to fill the place of Prof. H. T. Plumb, who will be away on a year's leave of absence. Professor Biegler is a graduate of the University of Wisconsin and, aside from valuable experience in power-station construction work, has been engaged three years with the Commonwealth Edison Company of Chicago. He also served as assistant professor of electrical engineering at the University of Iowa. Mr. John C. Potter comes from the American Telephone & Telegraph Company to take charge of the work in telephone engineering. Mr. Potter is also a graduate of the University of Wisconsin, where he has obtained the E.E. degree. He has been engaged for three years as instructor at the above university, as well as for three years with the long-distance telephone company in different parts of the country. He has also done considerable work as expert for the Wisconsin State commission.

The position of assistant in the electrical laboratory will be

filled by Mr. C. W. Piper, who is a graduate of Rose Polytechnical Institute. He has had practical experience in the apprentice course of the Westinghouse Electric & Manufacturing Company and as assistant electrical engineer for Adams & Westlake, of Chicago, where he has been doing special research and design work on potential regulators for train lighting. Professor C. R. Moore and Mr. R. L. Witham, who have in the past assisted Professor Esterline in the design department, will have the responsibility of this portion of the work during the coming year, Professor Esterline having resigned to devote his entire time to his commercial interests. Professor Moore has been associated with the design department of the General Electric Company, and Mr. Witham with a similar department of the Fort Wayne Electric Works during the past summer.

Conference on Proposed System of Accounts in New Jersey.

A conference on the subject of a proposed uniform system of accounts for electric lighting and power companies was called by the New Jersey Board of Public Utility Commissioners at Trenton on Sept. 22. Commissioner Thomas J. Hillery presided.

In calling the meeting to order Commissioner Hillery said that under authority of the law relating to uniform accounts the commission thought it advisable to have a preliminary meeting with representatives of the companies and receive their advice and suggestions on the subject.

To furnish a basis for discussion Mr. Philander Betts, chief inspector of the utilities division of the commission, was asked to state his views on the subject. Mr. Betts said that a uniform system of accounts for electric companies had been given considerable attention in the country for some years and that as a final culmination a classification had been recommended by the National Electric Light Association. This classification was incomplete, but to furnish a basis for discussion he would recommend its adoption.

Mr. E. J. Allegaert, auditor Public Service Corporation of New Jersey, said that he was a member of the committee which recommended the National Association classification. He thought that this classification should be adopted ultimately, but that a little more work was needed on the system. He would suggest that the system might be prepared for adoption by, say, Jan. 1, 1912.

Mr. Frank J. Pryor, Jr., comptroller American Railways Company, which controls the Bridgeton Electric Company, said that he represented a holding company. New Jersey was the first state in which this company owned properties where a uniform system of accounts for electric lighting companies had been suggested. The accounting committee of the National Association intended to continue its work. Its system would be the recognized one and would be established as the standard in other states. A uniform system in all the states would be desirable. He therefore recommended the adoption of the National Association classification.

Mr. Thomas W. Haldeman, vice-president Washington Electric Company, was not familiar with the National Association classification. The system adopted by his company was simple and furnished sufficient information regarding the business. He thought the National Association classification might be too elaborate for a company operating in a town of 4000 population. If it could be changed so as to be adaptable to the requirements of companies with large or small earnings it might be entirely satisfactory.

Commissioner Hillery said that there was no disposition on the part of the commission to burden the smaller companies with a system of accounts intended for large companies.

Mr. Allegaert said that the National Association committee had not gone far enough in its work to make a division for companies with operations of different amounts. Very small companies could use the eight general operating expense accounts. Either the National Association committee or a joint committee representing the New Jersey commission and companies should prepare a classification that would be satisfactory for the small companies.

Mr. Mitchell B. Perkins, Cinnaminson Electric Company and Bordentown Electric Light & Motor Company, used a simple system which had been prepared especially for those companies.

Mr. Betts thought it would be desirable to have the commission analyze the different schemes and make recommendations. He thought that the system would have to provide, like that of the American Street & Interurban Railway Accountants' Association, for different grades of companies. Accounts dealing with the operation of power plant ought to be kept under one heading in a property transacting both electric lighting and railway business. If kept by the lighting company the amount paid by the railway company should be carried as a credit by the lighting company, or in some manner as an offset to the cost of operation.

Commissioner Hillery said that complete sets of accounting forms would be valuable to the commission. The commission would take under consideration the suggestion of the appointment of a joint committee. The system of accounts must be worked up gradually.

Mr. Betts spoke of the recommendation of the Public Policy committee of the National Association that, in view of the decisions of the United States Supreme Court in the Knoxville and Consolidated Gas cases, each company make a full and fair appraisal of its property. Such a valuation would be of interest to each company. Many companies did not know what their properties were worth. A valuation ought to show both the cost to reproduce and the present value.

Mr. Allegaert said the question of cost was very serious and difficult to determine.

Mr. P. S. Young, comptroller Public Service Corporation, thought valuation would be very costly for the companies. An inventory would be desirable, but values fluctuate from day to day. Separate valuations made by different engineers might be 50 per cent apart.

Mr. H. C. Case, Lambertville Heat, Light & Power Company, said that that company required about thirty operating expense accounts.

Commissioner Hillery, in conclusion, said that the commission desired to help the companies solve their problems.

Boston Edison Company's Annual Report.

The Edison Electric Illuminating Company of Boston has filed its return for the year ended June 30, 1910, with the Massachusetts Gas & Electric Light Commission. The return covers the districts of Boston, Milton, Dedham, Natick, Framingham, Somerville, Woburn, Medfield, Brookline, Newton and Chelsea and includes thirty-four cities and towns, in which are 33,834 customers. In Boston the company now has 19,557 customers, showing a gain during the year of 2708, or 16 per cent. The gain in customers in the whole territory for the year was 10,196, or nearly 45 per cent, the increase outside of Boston being in considerable part due to the acquisition of the suburban companies supplying the Newton, Brookline and Chelsea districts.

The company's total income for the year was $4,709,456.03,

Commercial lighting	$3,140,758.11
Public street arc lights	462,974.87
" " incandescent lights	151,511.00
Electric power for railways	107,708.21
" " " other uses	763,884.66
Sales to other companies	82,619.18
Total	$4,709,456.03

a gain of $598,113.33 over 1909, or 14.5 per cent increase. The total expenses, including manufacture, purchase of electricity, distribution, office expenses and management, taxes and miscellaneous expenses, were $2,688,720.23. The balance to profit and loss was $2,020,735.80, compared with $1,345,313.41 a year ago. The ratio of total expenses to total income for 1910 was

58.3 per cent, compared with 67.5 per cent a year ago. The earnings were as shown above for the fiscal year 1909-10.

These results show that the company gained in revenue in every item except sales to other companies, the increases being as follows: Commercial lighting, $386,903.24; public arc lights, $60,084.91; public incandescents, $50,539.97; power for railways, $50,699.78; power for other uses, $127,376.27.

The subdivision of operating expenses for the year was as follows:

Manufacture	$766,319.28
Purchased electricity	162.35
Distribution	555,690.22
Office expenses and management	511,530.47
Taxes	546,508.18
Insurance	67,500.00
Legal expenses	53,984.41
Bad debts	14,000.00
Incidentals	173,025.32
Total	$2,688,720.23

The total cost of all plant on June 30, 1910, was $27,526,964.26, the larger items being underground lines, $6,367,277.39; buildings, $4,151,663.20; electric plant, $4,417,768.20; steam plant, $3,989,401.22; overhead lines, $3,514,709.42, and land, $1,390,-899.45. The total cost of the plant was $9,623,864.20 more than capital and loans. The value of purchased properties during the year was $1,947,653.09. The total capital outstanding is $15,543,600. The total plant additions during the year amounted to $3,860,596.69. Plant depreciation was charged off at $439,-539.80. The total dividends declared were $1,555,596. The total liabilities were $28,769,904.09 on June 30, 1910.

The company owns 36,024 boiler hp and 104,400 hp in steam engines and turbines. The capacity of its direct-current generators is 10,400 kw and of alternators 63,450 kw. The company's distribution system consists of 2,935,806 ft. of municipal arc wire; 6,968,513 ft. of municipal incandescent circuits; 59,176 ft. of direct-current lighting service wires (commercial); 9,575,-977 ft. of alternating-current primary wire, and 5,667,384 ft. of secondary wire. There are now installed 883,446 ft. of conduit containing 7,056,407 ft. of cable not in Edison conduit service. There are 3350 line transformers in service. The connected load is as follows:

	Kw.
Municipal arcs	2,910
Commercial "	2,928
Municipal incandescents	599
Commercial "	71,021
Power	42,821
Total connected load	120,279

The company has 1512 customers using motors only. The total energy delivered at the switchboard for the year was 112,997,835 kw-hours and the total output sold or accounted for was 81,368,354 kw-hours, of which about 20,000,000 kw-hours were for motor service. The maximum load on the station during the year was 41,693 kw, the date being Dec. 1, 1909. The company burned 111,136 tons of coal during the year, the average cost per ton used being $3.47. There are now 1160 employees, the largest number, 403, being in the distribution department. The average net cost of production per kw-hour delivered at the station busbar was 0.68 cent.

Colorado Electric Convention.

The eighth annual convention of the Colorado Electric Light, Power and Railway Association was held at Glenwood Springs, on Sept. 21, 22 and 23. Special trains from Denver, passing through Colorado Springs and Pueblo, were run by both the Colorado Midland and the Denver & Rio Grande railroads for those attending the convention. Owing to the late arrival of special trains no regular session was held on the morning of the 21st. But about seventy members enjoyed a good swim in "the pool," 400 ft. x 100 ft., supplied by warm sulphur springs. The afternoon session was called early, and the roll call showed sixty members present. The reading of the minutes being dispensed with, President Wm. T. Wallace gave a short address, especially emphasizing the growth of membership and influence of the organization, its duties and opportunities. He spoke of the unprecedented extension in electrical applications, especially in mining and agriculture. In view of the probability of passage of a public service commission law, which is being urged by many parties, Mr. Wallace stated that the association should openly interest itself to bring about the enactment of a measure which would be fair to the public and the service company alike. A special committee was recommended to represent the association in conferences with other bodies, including state conventions and legislatures, the president stating that such a law should operate beneficially in every way.

ENTERTAINMENT FEATURES.

At the opening of the 10 o'clock session on Sept. 22 a baseball game between the association and the Colorado Electric Club was announced for 3:30.

The afternoon meeting adjourned to the baseball field across the Grand River. The batteries of the Colorado Light, Power & Railway Association and of the Colorado Electric Club were respectively Rundel and Deesz, and Glaze and Rickard. The score in the six-inning game stood 6 to 14. Errors were in so much dispute that record was impossible. The extremely thorough policing of the premises by the Sons of Jove brought order among the more obstreperous rooters, while other Jovians sold peanuts, cigars, pop and chewing gum on the grandstand, netting enough to maintain the Jovian booth at the coming Denver Electrical Show. It was remarked that after the first round most of the purchased cigars were surreptitiously replaced in the box and the profits increased accordingly. Manager Lucas, of the Hotel Colorado, umpired, and the hitting of Carter, electrical engineer of the Denver Gas & Electric Company, was the feature of the game, accounting for five of the Colorado Electric Club's runs.

During the evening an executive session was held, and reports of treasurer, auditor, etc., were received.

TUNGSTEN STREET LIGHTING.

The advantageous features of tungsten street lighting over other systems were described in a paper by Mr. Howard L. Aller, Denver. The author gave data to show that, although the tungsten lamp is not so efficient an illuminant as the arc lamp, yet better illumination results can be obtained by placing small tungsten lamps at short intervals than by using the more powerful arc lamps at large intervals. Moreover, the glare effect will be less with tungsten than with arc lamps.

The paper by Mr. Aller brought out considerable discussion on the absorption of light by enclosing globes, and the relative results of arch, post and suspension use. Some figures showing good life, the effectiveness of the film cut-out and the successful operation of series wiring in posts with underground feed were presented.

A special committee appointed last year to present recommendations to the association on meter practice then made its report. Mr. F. P. Cummings, of the Denver Gas & Electric Company, the chairman, was obliged to make abstracts from this report, which represents a distinct addition to literature on meter operation in its collected data and in its practical treatment by Mr. Cummings of experimental results following exhaustive tests by Mr. Buel, of the Northern Colorado Power Company, and himself. This report is to be printed and issued to members in pamphlet form. Discussion was omitted awaiting the publication of the report.

FRIENDLY RELATIONS WITH THE PUBLIC.

Mr. J. M. Connelly, Denver, presented a paper discussing in a convincing manner the advantages to a public-service company of cultivating friendly relations with the public. The author showed in what way wrong impressions are frequently conveyed, especially to representatives of newspapers, by reason of indifference or rudeness. He remarked that the old régime of the corporation, bound and blinded by a foolish independence, erroneously considered one of the excellent advantages of a monopoly, has passed to a deserved oblivion and

the principles that obtain in the transaction of private business under the discipline of competition are being largely employed by the utility companies in dealing with their customers. The author entered a special plea for publicity concerning the affairs of a company in order to keep the public informed as to its needs and intentions.

DISTRIBUTING CIRCUITS.

A convenient system for keeping record of the locations of distributing circuits and transformers was described in a paper by Mr. J. C. Lawler, Colorado Springs. Use is made of maps drawn on tracing cloth, each circuit being drawn separately and showing the location of lines and the position of the conductor on the pole; certain signs are used showing the location of lightning arresters, size of wire, location and number of transformer, etc. The map also indicates the ownership of the poles and shows whether the line is a primary or a secondary circuit. These maps are cut in sections about 10 in. x 12 in., and kept in book form. The tracing permits blue prints to be made. The transformer numbers are written in lead pencil to facilitate erasures. The small sections make the map easy to handle, and obsolete sections can be replaced without redrawing the whole map. A transformer record is maintained in the office by a card system. Each transformer is indicated by a card showing all the name-plate data, when purchased, number, location, date installed and removed. Back of this transformer card is an address card giving the address of the consumer, dates connected and disconnected, meter number, its installation and approximate demand, each installation having an individual card. The approximate demands are added to determine the load on the transformer. This arrangement prevents overloading of transformers and gives the engineer a comprehensive idea of what is going on over his circuits. Mr. Lawler very thoroughly outlined practical operating features, and urged especial attention to the rapidity of Western town growth and the development of a broad enough plan for construction to obviate necessity for the usual makeshift extensions to accommodate customers and their changes of location.

The discussion on Mr. Lawler's paper centered largely upon the question of sectionalizing secondaries or of interconnecting them. Mr. Carter, electrical engineer of the Denver Gas & Electric Company, expressed the belief that separate blocks are more convenient and ideally more systematic, but require more copper for equal loss and equally satisfactory service, and fail to supply an equally reliable ground where secondaries are grounded. Other discussion, principally by Mr. G. B. Tripp, manager of the Colorado Springs Light, Heat & Power Company, developed that in the smaller towns separate secondaries if mechanically strong would give no difficulty from excessive voltage drop.

Mr. J. F. Dostal, electrical superintendent of the Denver Gas & Electric Company, as member of the N. E. L. A. committee on line construction, recommended that a local committee be appointed to investigate local conditions and confer with the national committee with the object of standardizing materials and methods. The Dostal drop-out connector for high-tension crossings was discussed and was said to afford effectual protection. Its general endorsement was noted as an advance over the various net and short-span arrangements in both installation and maintenance costs with equal assurance of safety.

CREOSOTE TREATMENT OF PINE POLES.

Much information relating to the creosote treatment of pine poles was given in a paper by Mr. George R. Ogier, Denver. It was claimed that, by creosoting, the useful life of pine poles would be increased from five to twenty years. The author stated that creosoting not only prolongs the life of the durable species of wood in use, but it prolongs the life of the inferior and cheaper woods, and enables the utilization of inferior woods, which without the preservative treatment would have little or no value.

The discussion on Mr. Ogier's paper indicated that in the dryer climates the part of the pole above ground receives very little benefit from treatment. Carbolineum and creosote painting have been tried by some members and seem to be a palliative only, usually leaving a hard shell, but allowing decay to proceed under the shell. Concreting was advocated by Mr. W. G. Matthews, superintendent of line for the Denver City Tramways Company, who is using a great deal of concrete setting, and to some extent concrete collars for poles partially destroyed at the ground line. No exact information on increased life of poles with concrete butt protection was available.

INDUCTION GENERATORS AND ROTARY CONDENSERS.

At the morning session on Sept. 23 Mr. A. L. Jones, engineer of the General Electric Company, Denver office, presented a paper discussing in an instructive manner the performance characteristic of rotary condensers and induction generators. Having discussed the use of an over-excited synchronous motor as a condenser for absorbing leading wattless current and thereby neutralizing an equal amount of lagging wattless current taken by other machines, the author outlined the advantages of employing this arrangement in preference to installing extra generators when the equipment is fully loaded. He claimed that the extra load that can be carried by a generator operating at a high power-factor in comparison with the load carried when the power-factor is low more than offsets the cost of the synchronous condenser for raising the power-factor.

The author described the use of an induction motor driven above synchronism as an alternating-current generator. He called attention to the fact that the induction generator cannot supply current to a short-circuit. He said that on large cable systems, and where a short-circuit involves a tremendous amount of power, this characteristic might be of great value. On a cable system also the charging current of the cables would partly supply the magnetizing current required by the induction generator and remove to some extent an objectionable feature of this type of machine. High-speed steam-turbine work seems to be the most promising field for induction generators, since the simple mechanical construction of the squirrel-cage rotor permits a high speed and high operating temperature without injury to the machine. It has also been proposed for gas-engine work where parallel operation of synchronous machines is usually secured at the expense of heavy flywheels and elaborate damping devices on the pole faces, and where, even with these, successful operation is not always possible. If instead of synchronous units, induction generators were installed having high-speed synchronous motors running light to supply the excitation for the outside load and for the generators there would be no necessity of limiting the angular variation of the gas engines to the present very exacting figures.

The author mentioned some of the objections to the induction generator. He remarked that it is distinctly a secondary and dependent piece of equipment, unable to function unless in connection with synchronous generators. It is unable to produce any wattless current, of which most modern systems require considerable. It requires such a large magnetizing current that the induction generator can bear only a small proportion to the rating of the synchronous machines, and its good effects are consequently reduced. While the simple mechanical construction should make the cost of such a machine less than that of the more complicated synchronous generator, heavy engineering and development charges will have to be borne by the first machines produced, which will probably make them cost more than the synchronous generators. There has been practically no demand for this type of generator, which shows that as yet the American power-station practice does not consider that the advantages of the induction generator can offset its many disadvantages.

In the discussion Mr. Jones explained the limitations of rotary converters for supplying leading current for excitation of the system. Unless a good direct-current load is utilized the armature conductors soon overheat, as they are designed for the small current difference between the input and output

ends. The interesting point was further developed that in the experience of most member companies the installation of oversizes in motors was responsible for much of the low power-factor prevailing on most mountain distributions. Salesmen of electrical companies came in for some criticism, but lack of data by machine manufacturers, and the consumer's desire to "add 50 per cent for safety," were considered the chief causes of this condition. Some distributions report a power-factor of from 40 per cent to 60 per cent. The remedy, outside of rotary condenser installations, seems to lie in a change in the connected load. Hoists form undesirable loads, and one company, the Colorado Light & Power Company, declines to connect to hoists rated at more than 75 hp, claiming that a profitable rate is prohibitive to the consumer. The load factor on single hoists is from 3 per cent to 8 per cent, and on double hoists it is 7 per cent to 16 per cent.

THE GROUNDING OF SECONDARIES.

The committee on the grounding of secondaries, of which Mr. J. A. Clay was chairman, submitted a report based on the replies received from seventeen companies to thirteen questions relative to the grounding of secondary circuits. Attention was called to the rule of the National Electrical Code that motors operating at a potential of 550 volts or less be thoroughly insulated from the ground where feasible. The committee expressed the belief that the operating conditions existing with a large number of companies of the association are a menace to the life of employees operating motors under these conditions, particularly where such motors receive energy from transformers stepping down from a relatively high potential, that is, potentials above 5000 volts, and suggested that this matter be brought to the attention of the National Board of Fire Underwriters, because in a case of this kind the grounding of the secondaries supplying energy to an insulated motor would not give absolute protection.

The committee recommended that the question of grounding be brought more forcibly before the member companies in order that more definite information and a closer study and results may be obtained.

The discussion of the report was animated. Mr. Carter, electrical engineer of the Denver Gas & Electric Company, gave a very complete outline of the reasons for grounding, noting personal injuries and fires where high voltage on secondaries was undoubtedly involved. He explained his company's method of grounding and of handling the change in meter loops to outside wires. He frankly stated that in grounding neutrals it was usual to find a heavy ground already existing on one wire, more frequently an outside, and that the 220-volt life and fire hazard could be usually found where secondaries were not definitely grounded at the neutral. He recommended grounding to secure the lowest normal potential in any secondary system, and suggested that most of the desire for limitation of grounding to 150 volts was the result of aversion to change in previous convictions. This same cause was assigned for the neutral attitude assumed by many underwriting bodies. The discussion was continued by Mr. Clay, Mr. Farr and others. Actual reductions from lighting troubles were claimed by several grounding companies. The special difficulties of securing adequate grounds in some localities were brought up.

Finally, following a résumé of the situation by Mr. W. D. Wallace, a resolution was introduced and carried endorsing grounding secondary circuits carrying electromotive forces up to 150 volts, leaving the question of motor circuits open, though practice is strongly for grounding up to 440 volts, and many companies have definite rules to such effect.

A further resolution endorsed the grounding of motors, switch and transformer cases on secondaries operating at 220 volts and above. One company reported serious injury from a motor case at high potential. For the present it was deemed advisable to let the member companies decide each for itself whether it would be good practice to ground a motor case and not the secondary feed wire.

STEAM TURBINES.

A paper by Mr. E. M. Gilbert, Denver, entitled "Steam Turbines," dealt with many of the general details and operating features of steam turbines. In comparing steam turbines with reciprocating engines the author claimed for the former the following advantages: Reduction in space occupied; smaller foundations; saving in oil; absence of oil in condensed steam; less vibration; better regulation; greater simplicity; maintenance of efficiency throughout life, and "economy," especially with loads fluctuating heavily. The author called attention to the fact that a low-pressure turbine can be applied advantageously to any plant where reciprocating engines are used, being connected between the exhaust of the engines and the steam condensers. He cited a certain case where three 1000-hp reciprocating engines operating alone consumed 31 lb. of steam per kw-hour, while when used with a 1500-kw exhaust-steam turbine the specific steam consumption was reduced to 17.7 lb. per kw-hour, the turbine carrying about 70 per cent of the total load. The cost per kw-hour was reduced from 0.67 cent to 0.47 cent by installing the turbine.

OFFICERS.

Following the presentation of the report of the nominating committee the following officers were elected: President, Mr. H. L. Corbett, manager of the United Hydroelectric Power Company; vice-president, Mr. J. A. Clay, San Juan Water & Power Company. An amendment to the constitution of the association makes the secretary an appointee of the president. The name of the secretary has not as yet been announced.

Hydroelectric Power Development in Central Massachusetts.

Through the expansion of the facilities of the Easthampton Gas Company in the past few weeks hydroelectric power developments are being actively pushed in the Connecticut Valley district of Massachusetts. About Aug. 1 of the present year a new transmission line was placed in service between Amherst and Mount Tom, and hydroelectric power from the generating plant of the Turners Falls Power Company delivered to Easthampton for general industrial and local service. The energy supplied from Turners Falls is transmitted over the line of the Amherst Power Company to Amherst, a distance of about 18 miles, and thence to a substation at Mount Tom, 10 miles from Amherst. The line potential is 23,000 volts at present, with the prospect of an increase at a later period. The line between Turners Falls and Amherst is of the wooden-pole type, and has been in service for some time. The new construction between Amherst and Mount Tom is of the steel-tower design. A single three-phase circuit is carried throughout the entire length of the line.

In order to maintain continuous service of adequate capacity the Easthampton Gas Company is now building a modern steam-turbine plant at Mount Tom, on the property adjoining the substation. The initial capacity of the steam plant will be 1000 kw, and the present substation capacity is 1500 kw. From the substation at Mount Tom as a distributing center the service is carried to Easthampton over a 4600-volt line, and at the West Boylston Mills the potential is reduced by step-down transformers for motor applications at about 440 volts. At the old steam plant of the Easthampton company electricity is transformed for local lighting and small motor service at 2300 volts. The Easthampton company expects to have the turbine station ready for operation by Oct. 15, using the steam plant as an auxiliary to the hydroelectric supply. The Mount Tom station is about three miles from the center of Easthampton. The construction work has been handled by the local companies under the direction of Mr. Howard M. Turner, supervising engineer, and the consulting engineers for the entire work are Messrs. Thomas & Neall, New York and Boston.

New York Commission News.

It was announced last week at the office of the Public Service Commission of the First District of New York that an agreement had practically been concluded with the Interborough Rapid Transit Company whereby title to the Steinway tunnel, running from 42d Street and Park Avenue under East River to Long Island City, would be taken over by the city free of cost, and a contract made with the Interborough Company for its operation; permission being granted for third-tracking the Second, Third and Ninth Avenue lines, the extension of the elevated lines across the Queensboro Bridge and the extension of the elevated system in several directions in the Borough of the Bronx, It is proposed to transport passengers from Long Island City to any station on the subway system for one fare. Chairman Willcox states that as soon as this agreement is ratified by the proper authorities work can be commenced upon the extensions. A public hearing has been called by the commission upon the project for Oct. 1.

The New York Public Service Commission, Second District, has granted its permission and approval for the exercise of a franchise granted to the Avon Electric Company by the town board and town superintendent of highways of the Town of Geneseo for the purpose of furnishing electric light service in that town.

The commission has made an order requiring all telephone corporations to file on or before Oct. 1, 1910, schedules showing all rates and charges of all kinds between points in New York and between each point upon its line and all points upon every line leased or operated by it and all points upon the line of any other telephone corporation whenever a through service or joint rate shall have been established between any two points. The company is also required to furnish the commission with each issue of directory of subscribers of the various companies. The commission has also made an order requiring all telephone and telegraph corporations to report all accidents happening in connection with the work of these corporations.

Canadian Hydroelectric Commission News.

The difficulty between the Toronto City Council and the Hydroelectric Commission over the selection of the route through the exhibition grounds of the transmission line from Niagara Falls to Toronto has been satisfactorily arranged. At a meeting of the Council on Sept. 20 Mr. P. W. Sothman, chief engineer of the commission, stated that energy would be delivered in Toronto within a month if this gap through Exhibition Park was closed up.

The commission held an important meeting at Toronto on Sept. 20, with all the members present. It was decided to enlarge the territory served with cheap energy. The commission has secured an option on 15,000 hp from the Ontario Power Company to supply energy to the municipalities in the extreme eastern portion of the Province of Ontario.

The municipalities of Morrisburg and Prescott have made application for service, and the commission has instructed its engineer to furnish them with an estimate of the cost, based upon the price received from the Ontario Power Company. It is understood that the price to Morrisburg, where 2000 hp was asked for, will be $16.33 per horse-power per annum, while to Prescott, which desires 1000 hp, the rate will be $22.13 per horse-power per annum.

Contracts have been let for the substation at Port Credit as follows: Building, Stewart Brothers, Port Credit; transformers, Allis-Chalmers-Bullock, Limited, Montreal; switching apparatus, Canadian Westinghouse Company, Montreal.

The commission finally decided that the ceremonies for the opening of the transmission lines for service shall take place in Berlin early in October. The ceremonies will consist of an electrical display of an extensive character and the municipality will give a banquet to commemorate the occasion.

Massachusetts Commission News.

Protests against the recent action of a majority of the Railroad Commission in the Boston & Eastern Electric Railroad project continue to be voiced in the press and elsewhere in the North Shore district near Boston. Mass meetings have been held on behalf of the new road, which desires to obtain a certificate of public convenience and necessity from the commission in order to start detailed engineering in connection with the actual construction of the railroad. The company plans to build a high-speed double-track line on a private right-of-way between Boston, Lynn, Salem and Beverly, and if its plans are carried out the time of transit between Boston and the North Shore will be cut far below anything ever before known. As outlined in these columns, there has been strenuous opposition from all existing transportation agencies, and the commission recently voted to lay the matter on the table until the Legislature of 1911 has had a chance to investigate the problems at issue. On Sept. 19 a large delegation of prominent municipal officials and residents of Essex County called upon Governor Draper and lodged a protest against the action of the board. President Bauer, of the Lynn Board of Trade, charged the commission with evasion of duty, and urged the Governor to use his influence as chief executive of the State to obtain an immediate decision of the board either for or against the road. The delegation stated that it desired the road to be built as soon as possible, but that in any case it wanted an immediate decision. Governor Draper said in reply that the commissions in the State act independently of him, although they are appointed by the executive. He assured the delegation that it had his sympathy, and that he would use his influence with the commission to see that a decision is rendered at once, one way or the other.

The Railroad Commission has declined to recommend that the Old Colony Street Railway Company be obliged to establish transfer stations in the City of Brockton during the Brockton fair.

One of the later rate cases to be heard by the Massachusetts Gas & Electric Light Commission is the petition of the Mayor of the City of Newburyport for a reduction in the price of both gas and electricity furnished by the Newburyport Gas & Electric Light Company. In accordance with its usual practice in appeals of this kind the full board gave a public hearing to the parties in Newburyport. The petitioners contended that the price of gas, $1.40 per 1000 cu. ft., was too high for the best interests of the community, and, in connection with the electrical prices, charges of discrimination were made. Mayor Robert E. Burke contended that a dividend of 8 per cent was unduly high, and also argued that the street-lighting prices were excessive.

The principal argument for the company was made by its manager, Mr. A. W. Rogers, who stated that in the past eight years every effort had been made to bring the local plant up to modern standards of construction and operation including a progressive distribution policy. He pointed out that the original plant was located in a three-story wooden building which covered all the land that the company owned, so that the stack had to occupy leased land. The machinery was pretty well out of date, with no chance to redesign the station. A new station was, therefore, built, with modern equipment. The policy of the company has been to supply the best grade of service and reach out for new customers in a liberal manner. Mr. Rogers said that the only business way of running a manufacturing concern like a central station is, first, to give the customers the best quality of service; second, to keep the plant in first-class condition and repair; third, to be liberal in making extensions; fourth, to give the stockholders a fair return on the money; and fifth, to lay aside a reasonable amount for depreciation and then, as fast as the growth warrants it, reduce the price. It was shown that the population of Newburyport remains practically at a standstill, and yet since 1902 the price of gas and electricity has

been reduced, a new station built, a gas holder added, and other improvements have been made. In the past seven years the mileage of street mains increased from 14 to 24; the number of gas stoves from 340 to 1107, and the number of gas meters from 894 to 1810. The wire mileage had increased from 38 to 57; the number of transformers from 10 to 128, and the number of electric meters from 96 to 371. The number of arc and incandescent lamps had also increased, and the assessed valuation of the plant had increased from $154,500 to $307,800. Mr. Rogers asked what other enterprise had come into Newburyport, a city of about 15,000 people, and increased its valuation to such an extent? The taxes have increased in seven years from $2,569 to $7,617, an increase of $5,048. The gross income has increased from $52,767 to $93,485, and the earnings are now 2.75 per cent less on the capital stock than in 1902. Mr. Rogers said that there have been very few improvements or changes in the manufacture of coal gas that can be used by companies making less than 100,000,000 ft. per year that will materially reduce the cost of manufacture, and the cost of labor and most of the material entering the cost of manufacturing and distributing gas are very much higher. The cost of gas coal at tidewater point of shipment was 5 per cent higher in 1909 than in 1902, and labor is 20 per cent higher.

It was argued that the company in making liberal extensions had reduced the average amount of its product sold per mile of main, and the average per customer has also decreased, since, in extending into the outer districts, a good many miles of main have been added, with an accession of many small consumers. The price at which electricity can be sold depends largely upon the quantity which the market can absorb. Fixed charges are reduced as the sales increase. As the company does not have a large day consumption of gas, it cannot do as much business on the same investment as otherwise would be the case. Mr. Rogers said that it costs 97.2 cts. now per 1000 cu. ft. to deliver gas to the consumer under present conditions, exclusive of depreciation and fixed charges. Mr. Rogers further stated that he considered the net price for electricity, 15 cents per kw-hour, reasonable for the size of the city, and pointed out that the volume of the business greatly affects the possible price. The board has the case under advisement.

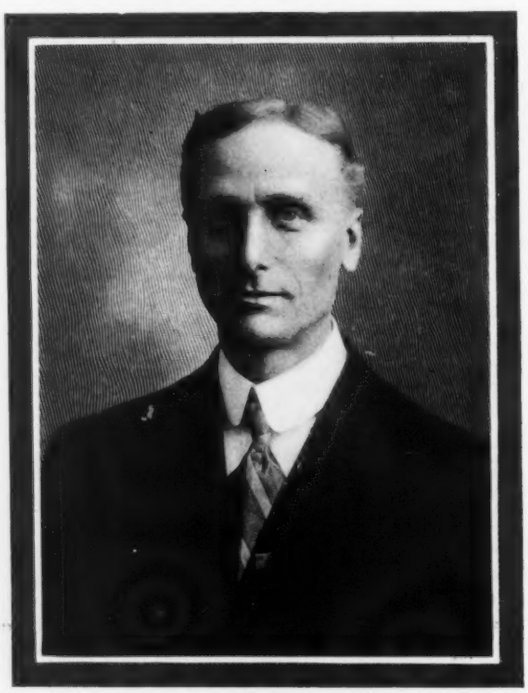
Objections continue to be raised against the new schedule of rates which the Massachusetts Highway Commission has recommended for adoption by the New England Telephone & Telegraph Company in the Boston and Suburban district. In spite of the fact that Prof. D. C. Jackson's exhaustive investigations of the traffic distribution showed that the larger part of intersuburban communication is between neighboring exchanges mass meetings continue to be held in various Boston suburbs with the object of securing modifications in the rates proposed. There has as yet been no opportunity to try out the new rates, for they have not been put into effect by the company. A so-called "Greater Boston mass meeting" was held at the American House, Boston, on Sept. 23, at the instance of the selectmen of Wakefield. A committee was appointed, with Representative Dean as chairman, to discuss the rate question with the New England Telephone & Telegraph Company. Failing to make an adjustment with the company an appeal will be made to the Massachusetts Highway Commission, and thence, if necessary, to Governor Eben S. Draper, with the request that the new rates be prohibited until action can be taken in the Legislature of 1911. It is considered unlikely that this agitation will be productive of any changes in the rates, for the reason that they were determined by the commission after one of the most profound analyses of costs and traffic ever made, the work being done by Messrs. D. C. and W. B. Jackson, of Boston and Chicago. It is recognized that in a metropolitan center like Boston, which virtually contains 1,500,000 people, scattered throughout nearly half a hundred municipalities surrounding the business nucleus, the needs of the majority of users must be given precedence to those of exceptional cases, which are to a small degree more interested in extensive intersuburban than in local suburban and interurban communication.

AMERICAN ELECTRICAL ENGINEERS—XV.

Edwin F. Northrup.

Edwin Fitch Northrup was born at Syracuse, N. Y., Feb. 23, 1866, where he attended the primary schools and after preparing for college at Cortland Normal School, Cortland, N. Y., entered Amherst College, Amherst, Mass., from which he was graduated with the degree of A.B. in 1891. While in Amherst he took an active interest in chemistry and philosophy and was one of the contributing editors of the *Amherst Literary Monthly*. Immediately upon graduation he entered the department of physics in Cornell University as a special student, and worked in the university shops through the summer of 1891. Special courses in physics and mathematics were pursued and part taken, as an assistant to E. L. Nichols, in a research on "The Time Infinitesimal."

In the beginning of 1892 Dr. Northrup entered the employ of Queen & Company, instrument makers of Philadelphia, Pa. The company had established an electrical laboratory at Ardmore, Pa., and was actively engaged in developing American



E. F. Northrup.

designs of electrical measuring instruments. In connection with his work in this laboratory Dr. Northrup took out two patents and contributed frequently to the technical press, which led to his appointment as a fellow in physics under Prof. Henry A. Rowland at Johns Hopkins University. He entered upon his fellowship in 1893, and his thesis, an original investigation in electricity, was completed in his first year and appeared later in the *Philosophical Magazine*. He was reappointed fellow the following year and received the degree of Ph.D. in physics in 1895.

Upon final graduation Dr. Northrup took charge for a short time of a six-mile electrical transmission plant of the "Monocyclic System," one of the first of its kind installed, which supplied electric power for the Ontario & Daly Mining Company, of Park City, Utah. He remained in Utah and Montana in miscellaneous practical electrical work until the fall of 1896, when appointment was accepted as head of the department of physics in the University of Texas, Austin, Tex. While occupying this chair he carried on an investigation of the etheric transmission of inductive action, the results of which appeared in these columns in the issue dated Dec. 18, 1897, and invented the "Northrup Oscillating Current Galvanometer." He was reappointed to the chair of physics, but left the university

shortly after to enter the detail laboratory of the Westinghouse Electric & Manufacturing Company, where he was chiefly engaged upon the standardization and design of alternating-current instruments.

In 1898 Dr. Northrup was called from the Westinghouse Company to assist Prof. Henry A. Rowland in the development of his alternating-current multiplex printing-telegraph system, in which work he was engaged four years. After Professor Rowland's death, April 16, 1901, he was placed in full charge as chief constructing engineer of the Rowland Printing Telegraph Company. Under his direction there was constructed a set of machines for operation between Berlin and Hamburg, Germany, the mechanical design of which was almost wholly his own. His work in connection with this telegraph system was recognized by the grant of a medal by the Paris Exposition of 1900. In 1902 he engaged with the Morris E. Leeds Electrical Instrument Company which in June, 1903, was incorporated as the Leeds & Northrup Company, with Mr. M. E. Leeds as president and Dr. Northrup as secretary. This company developed rapidly and placed upon the market many electrical measuring instruments of novel design, including inventions covered by sixteen patents granted to Dr. Northrup.

In September, 1910, Dr. Northrup concluded to lead a more scholarly life in an environment where he would have better opportunities for study and research in the higher and more refined branches of electrical measurement, and accordingly accepted the proffered chair of assistant professor of physics in Princeton University, the Palmer Physical Laboratory offering exceptional attractions to one of his tastes. He intends to continue to devote himself exclusively to that side of engineering and science which pertains to temperature and electrical measurements, and in addition to his university duties will act as a consultant on these subjects.

Dr. Northrup's contributions to engineering science have been confined principally to methods and instruments for precise electrical measurement. The chief of these are an original form of ballistic galvanometer (1892), which received an award at the Chicago Fair; a portable dry cell (1893); oscillating current galvanometer (1897); inventions connected with the Rowland Printing Telegraph, especially means for maintaining synchronism, page printers, keyboards and long-pull magnets (1898-1901). In the period from 1902 to 1908 his inventions include a four-coil decade system for resistance boxes; an alternating-direct-current comparator for alternating-current measurements; new designs of galvanometers; contributions to a new type of potentiometer; a line of resistance pyrometers; an electrical temperature recorder operating on a new principle; the working out of the law of pressure distribution in the interior of a conductor carrying current, and its application to an ammeter for the accurate measurement of currents above 1000 amp, direct or alternating; designs of indicating standardization wattmeters; a synchronizing tuning fork for the very precise speed control of small alternators.

Dr. Northrup has made numerous contributions to electrical literature, among which may be mentioned the following: A paper on "Dry Cells," *Journal* of Franklin Institute, March and April, 1893; "Specific Inductive Capacity," *Philosophical Magazine*, January, 1895; "A New Instrument for the Measurement of Alternating Currents," *Transactions* American Institute of Electrical Engineers, 1905; "Measurement of Temperature by Electrical Means," *Transactions* American Institute of Electrical Engineers, 1906; "Some Newly Observed Manifestations of Forces in the Interior of an Electrical Conductor," presented before the Physical Society and printed in *Physical Review*, June, 1907; "Conductivity and the Valuation of Electric Conductors," *Electrochemical Industries*, May, 1909; "A New Type of Ammeter for the Accurate Measurement of Alternating Currents Above 1000 Amperes," *Transactions* American Electrochemical Society, 1909; "Cooling Curves and a New Type of Apparatus for their Autographic Registration," *Transactions* Electrochemical Society, 1909; "The Comparison of Galvanometers and a New Type of Flat-Coil Galvanometer," *Journal* of Franklin Institute, 1910.

Dr. Northrup is a member of the American Institute of Electrical Engineers, fellow of the American Association for the Advancement of Science, member of the American Physical Society, member of the American Electrochemical Society and member of the Inventors' Guild.

CURRENT NEWS AND NOTES.

Electrotherapeutic Association.—The American Electrotherapeutic Association has elected the following officers: President, Dr. Frederick De Kraft, New York; secretary, Dr. J. Willard Travell, New York.

N. E. L. A. Growth.—The National Electric Light Association continues its growth, and during the summer has gained about 100 members per month, the number being now about 5820 as compared with 5500 at the St. Louis meeting at the end of May. The report of the St. Louis convention is now in the printers' hands and will make two volumes of over 2000 pages, embracing some seventy papers and committee reports.

Electrical Engineering at Armour Institute.—Of a class of 214 freshmen students entering Armour Institute of Technology in Chicago this year, about fifty are enrolled in the electrical engineering course. This is by far the largest incoming class in this course in the history of the school. The total number of students in the electrical engineering department is 141, and the total number in the college is 563. The professors in the electrical department are much pleased with the appearance of the students in the incoming class, and remark that they seem to be more mature men than in former years.

Peat for Fuel.—The peat plant installed by the Canadian Department of Mines at Alfred has turned out several hundred tons of peat, which is to be sold in Ottawa at the rate of $3.25 per ton delivered. This is being done as a demonstration of the commercial success of government experiments in preparing the peat for fuel purposes. The department claims that at this rate peat is equal to the best anthracite coal at $6 per ton. The department also announces that peat can be sold for fuel at the works at a profit for $2.25 per ton; this price is equal to hard coal at $4 a ton. It is expected that within a short time private enterprise will be putting peat fuel on the market in the vicinity of population centers. The Dorchester Peat Company, with a capital of $75,000 and head office at London, Ontario, has been incorporated to develop the peat fields about London.

Outing of Commonwealth Edison Women Employees.—The annual outing of the women employed by the Commonwealth Edison Company, of Chicago, was held at Ravinia Park on the afternoon of Saturday, Sept. 24. Included in the party by invitation were a number of the department heads of the company, many of them accompanied by their wives. Outdoor games were the feature of the afternoon, and in the evening there was a supper, followed by music and dancing. The company was the host of the occasion. The annual outing for the women of the company is an outgrowth of a visit to the model farm of Mr. Samuel Insull, the president of the company, at Libertyville, Ill., three years ago. So enjoyable was this occasion that the practice has been continued as an annual event since that time, the company taking pleasure in giving this little treat to its faithful employees of the gentler sex, with the addition of enough men to keep the affair from being too one-sided.

Tungsten Fields in Washington.—It is claimed that the largest and most promising tungsten field in the world is located in Stevens County, Washington, from 40 miles to 75 miles north of Spokane.

Wireless in Army Maneuvers.—During the recent French army maneuvers, in which 80,000 troops engaged, a number of dirigible balloons participated, each of which was supplied with a wireless telegraph equipment.

Photo-telegraphy at Denver Show.—On the opening night of the Denver Electrical Show, Oct. 8, an attempt will be made to send photographs by telegraphy from Chicago to Denver, a distance of over 1000 miles. It is estimated that $1,500 will be expended in conducting this experiment in photo-telegraphy.

Illinois State Electric Association Convention Dates.—The dates for the 1910 convention of the Illinois State Electric Association have been fixed as Oct. 25, 26 and 27, 1910. It will be held at Rock Island, Ill. Further information about this convention can be obtained from Mr. C. A. Willoughby, assistant secretary, Mayer Building, Peoria, Ill.

English-American Cable.—Work is now being completed on a transatlantic cable from Penzance, Cornwall, England, to Coney Island, by way of Roberts Bay, Newfoundland. The cable, which now lacks only 120 miles of completion, will be the property of the Western Union Telegraph Company, which will then own twenty-eight deep-sea cables having a total length of 18,759 miles.

Alleged Damage by Elevated Railway Structure.—Owners of property at 47 and 49 Fifth Avenue, Chicago, have brought suit against the elevated railway companies using the Union Loop, alleging that their property has been damaged by noise, obstruction to light and dripping of water, to the extent of $50,000. It is asserted that the elevated trains have made the corner of Randolph Street and Fifth Avenue the noisiest in Chicago.

Control of Gasoline Lighting in Pueblo, Col.—An ordinance recently passed by the City Council of Pueblo, Col., places all gasoline vapor-lighting outfits under the supervision of the city electrician. The ordinance also stipulates that all tanks, carburetors, generators etc., must be placed outside the building and tanks holding over 5 gal. must be buried 3 ft. underground. A penalty of not less than $5 nor more than $100 will be inflicted upon anyone disregarding the law.

New York Electrical Show.—A special feature of the fourth annual New York Electrical Show, which will open on Oct. 10 at Madison Square Garden and continue for ten days, will be displays of the numerous new electrical inventions and appliances that have been developed within the past year. A complete exhibit will be shown of the inventions of Mr. Thomas A. Edison. Several foreign firms have engaged space and all of the prominent American electrical companies will make exhibits of general interest.

Telegraph Typewriter for Battleships.—The United States Navy Department has arranged to equip the battleship *Nebraska* with a complete telegraph-typewriter system. The department intends to give the system a thorough test to determine its efficacy as a method of communicating range and target observations and fire-control orders in time of battle to all parts of the ship. The facts to be considered are whether the danger to such an instrument from gun fire might not overbalance its advantages and whether it can be operated speedily enough to compete with the telephone system.

Electric Protection for Treasury.—The United States Treasury at Washington has been equipped with electrically operated gongs so arranged that it will be impossible for an intruder to lift the latch on a door or touch the knobs on a vault without setting the gongs ringing all over the building. When the doors of the vaults swing shut after each day's business the system will become operative automatically, and when the doors close on the clerks another set of alarms will be set. The electric wires center in the watchroom, where guards are on duty every hour of the day and night.

Hydroelectric Development in Sweden.—Plans are being made to utilize the waterfalls near Aelfkarleo, Sweden, for industrial purposes. It is proposed to establish a plant for the supply of 5000 hp to the town of Gefle, sixteen miles distant, at a rate lower than is now charged by the existing plant at Gefle. It is hoped to secure customers for the new enterprise in Upsala, which is fifty-five miles from Aelfkarleo, and in other industrial places in the provinces of Upland and Gestrikland. The project will come before the next session of Parliament, and it is expected that construction work will begin next summer.

Increased Membership in I. E. S.—As a result of the membership campaign conducted for the Illuminating Engineering Society by Mr. Robert Crouse, assisted by Messrs. Philip Dodd and Napoleon Boynton, W. H. Gartley and H. B. Dates, 500 names have been added to the roll of the society. The increase represents about 50 per cent of the former membership. The new members were selected from well-chosen lists of persons specially interested in the subject of lighting, and since they will both give and receive value from their connection with the society, it is considered that the growth in membership is a healthy one.

Electrical Manual Training in Brooklyn.—The Department of Education of New York City offers free of charge in the Brooklyn Evening Technical and Trade School several electrical courses in manual training. One short and practical course covers electric wiring and installation. A four-year course in practical electrical engineering is also offered, beginning with the necessary mathematics and theory and followed by practical instruction in making, running and testing dynamos and other forms of electrical apparatus such as are used industrially. Steam engineering is also taught similarly, as well as industrial chemistry and elementary civil engineering.

Roentgen-Ray Insulator.—In a United States patent issued to Mr. Oscar Gros, of Leipzig, Germany, on Sept. 13, a description is given of a preparation impermeable to Röntgen rays. The preparation, which consists of white bolus coated with bismuth oxides, when used for filling the cavities of the body during examination, is said to yield an intense and uniform shading on the Röntgen plate. In manufacturing the preparation the inventor dissolves 10 grams of subnitrate of bismuth in diluted nitric acid and then adds to the solution 100 grams of white bolus. The mixture is then evaporated to dryness and subjected to calcination until nitrogen oxides cease to escape.

Electric Motors for Export.—According to an American consul a certain electric factory in a European country intends reducing the price of energy used during the daytime, thus make it pay even in small workshops to employ electricity as motive power. The consul states that in consequence of this there will shortly be a demand for electric motors from 0.5 hp to 20 hp. It is, therefore, advisable that American manufacturers of electric motors should send their descriptive catalogs with prices quoted in certain cities to the consulate in question for distribution among the intending users of electricity as motive power. Inquiries should be addressed to the Bureau of Manufacturers, Washington, stating the file number, 5556.

HYDROELECTRIC DEVELOPMENT ON THE ILLINOIS RIVER.

Details of the Proposed Low-Head Station of the Northern Illinois Light & Traction Company at Marseilles, Ill.

FOR more than forty years commercial use has been made of the water-power of the Illinois River at Marseilles, Ill. The Marseilles Land & Water-Power Company, a corporation headed by Mr. W. D. Boyce, a Chicago publisher and capitalist, owns the dam, headgates and races, leasing water rights to various hydraulic power users. The existing development under normal river conditions is capable of producing considerably more power than the present demand, which amounts to about 6525 hp, and this available surplus has recently been contracted for by the Northern Illinois Light & Traction Company, which has also secured the transfer to itself of some of the other older water leases. In this way the Northern Illinois Company, which is a subsidiary of the Western Railway & Light Company, of which Mr. W. B. McKinley is president and Mr. H. E. Chubbuck general manager, has obtained sufficient water-power to operate continuously a 2700-kw electrical generating station which it is now building at the site.

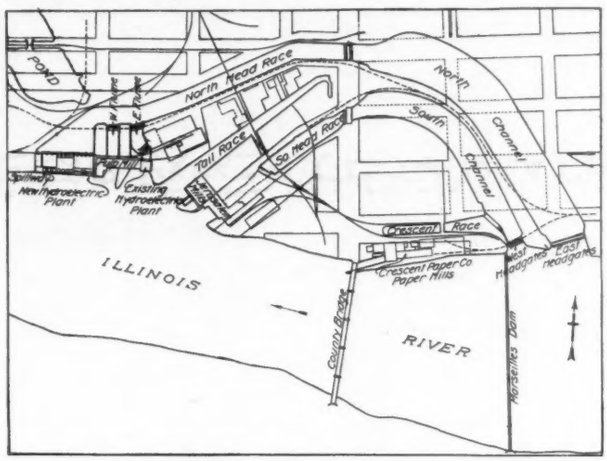


Fig. 1—Map of Marseilles Water-Power District.

The Consolidated Water & Light Company, of Marseilles, was also recently acquired by the McKinley interests from Mr. Boyce, together with the existing hydroelectric development, transmission lines and substations for distributing energy for lamps and motors in Marseilles, and for wholesaling to the local distribution companies at Morris and Seneca.

Fig. 2—Site of New Hydroelectric Development on Illinois River at Marseilles, Ill.

In the new plan, the Northern Illinois Light & Traction Company will be made the operating company, selling electrical energy at wholesale from the Marseilles generating station to Morris, Seneca, Ottawa, La Salle and Utica, and to the Chicago, Ottawa & Peoria Railway, which is also one of the McKinley properties. Eventually the new station will be tied in with other lines belonging to the Western Railways & Light Company. A steam plant at Ottawa will be floated on the system, supplying the peak-load demand, besides providing relay service. This arrangement will enable the new hydroelectric plant to operate at a load factor very nearly approaching unity.

Fig. 1 is a map of the Marseilles water-power district, showing the Marseilles concrete dam, of ogee section, 920 ft. long and 9 ft. high. Water is diverted through separate headgates into the north and south head-races The new power development will be located, as shown on the map, at the extreme westerly end of the north head-race and on the bank of the Illinois River, where an average head of 11 ft. is available. The flow of the Illinois River at Marseilles is fairly uniform throughout the year, resulting from the diversion through it of a large amount of Lake Michigan water by way of the Chicago River, the Drainage Canal and the Desplaines River. The north head-race, through which the new power development will receive its supply of water, is 2400 ft. long and has a minimum cross-section 80 ft. wide and 20 ft. deep.

Fig. 2 is a photographic view of the power site as it was before starting construction work and Fig. 3 is a reproduction of a photograph taken of the dam during the low-water period. Nearly all of the water shown flowing over the dam will be utilized in the new hydroelectric development.

Fig. 4 is a plan of the new generating station and Fig. 5 shows its construction in cross-section. The building will be erected on concrete foundations resting on a bed of shale. The superstructure will be built of brick with steel roof trusses and a tile roof. Across the forebay to the north of the power house a concrete bridge will be constructed, superseding a wooden bridge now existing at this point. This bridge is for the accommodation of the Manufacturers Terminal Railway Company, another property recently acquired by the McKinley interests. This bridge, as shown in Fig. 4, will also be utilized to support the racks in the flume leading to the turbine wheels. The arrangement of these racks is shown in Fig. 5 and they have been designed so that no steel projects above the water level, thus preventing in winter time the ready transmission of heat from the water through the steel to the colder air, which in freezing weather would cause anchor ice to form on the racks.

Fig. 3—Dam on Illinois River at Marseilles, Ill.

There will be twelve vertical turbine waterwheels installed in individual flumes and supported on suspension roller bearings. Six of these wheels are now in operation in the old power house and will be used to drive two 450-kw, 60-cycle, 2300-volt horizontal-shaft generators. Each alternator will be geared to its group of three water-wheels through shafting. The six new wheels are each to be direct-connected to 300-kw umbrella-type alternators operating at 72 r.p.m. These generators will all be three-phase, 2300-volt machines. Four of them will produce 25-cycle and two 60-cycle energy. Space will be left at one end of the power house for the installation of an extra unit, leaving room also for assembly and repair work.

A spur will run from the Manufacturers Terminal Railway track into this end of the power house, from which point a

25-ton electric overhead traveling crane will be employed for unloading and erecting machinery. This crane will also be utilized in handling the gates of the individual waterwheel flumes. These large steel gates will be available for shutting off any individual flume during an emergency, while in case a flume is desired to be closed for some length of time, wooden stop-logs may be inserted ahead of the gate, after which the

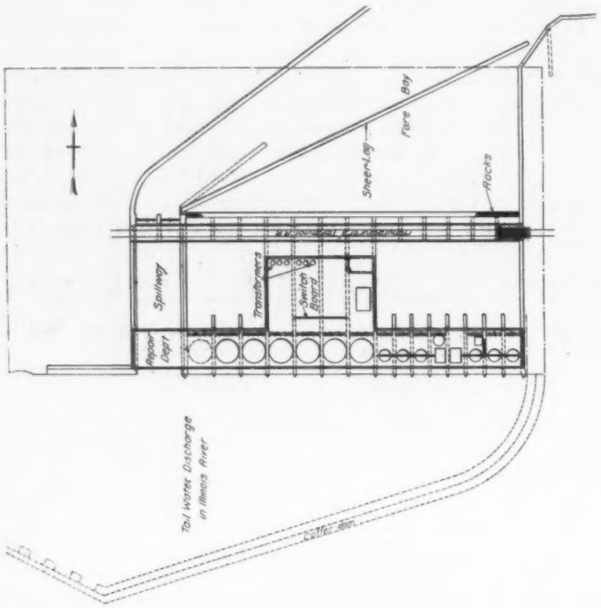


Fig. 4—Plan of Hydroelectric Station To Be Built at Marseilles, Ill.

latter may be drawn up and transferred by means of the crane to any other flume.

Excitation will be obtained from two direct-driven waterwheel generators, either of which will be of sufficient size for the demands of the entire plant. As electrical energy will be generated at both 25 cycles and 60 cycles, a frequency-changer will be installed in the station of sufficient size so that the entire capacity of the plant may be utilized for either the 60-cycle load or the 25-cycle load. This provision is necessitated by the fact that 25-cycle current must be furnished to the Chicago, Ottawa & Peoria Railway, now operating between Morris and Princeton, with a branch to Streator. For this railway five rotary-converter substations are now in operation. Since all the other demands on the station will be 60-cycle, and since the peaks of the two systems do not coincide, the power house has been designed to adapt itself to existing conditions. The unusually favorable load conditions under which this plant will operate permit the expenditure of a large sum of money to obtain the highest possible operating efficiency, and the owners look forward to obtaining the best that the art will afford. Operating costs have been carefully weighed against investment charges wherever there is a possibility of reducing the cost of production.

The high-tension transformers will be arranged in two banks. One bank will step up the potential of the 2300-volt, three-phase, 60-cycle circuit up to 33,000 volts, and the other bank will step up the potential of the 2300-volt, three-phase, 25-cycle circuit up to 15,000 volts. Either bank of transformers will be sufficient to handle the entire station output. The operation of the plant will be controlled from a centrally located remote-control switchboard designed to facilitate the rapid and efficient control of all apparatus.

A new substation is now in course of construction at Ottawa and others will soon be started at La Salle and Utica. In the Ottawa substation there will be installed three 200-kw, 60-cycle,

Fig. 6—Reinforced Concrete Poles on Transmission Line.

2300-33,000-volt Westinghouse transformers protected by electrolytic lightning arresters. Space is left in this substation building for another set of transformers of equivalent rating. This substation is located about 2500 ft. from the main plant at Ottawa and is designed for use either as a step-up or a step-down station, depending on whether energy is being received at Ottawa from the hydroelectric plant at Marseilles, or whether energy is being supplied to the system by the Ottawa plant, as will be the case during peak-load demands.

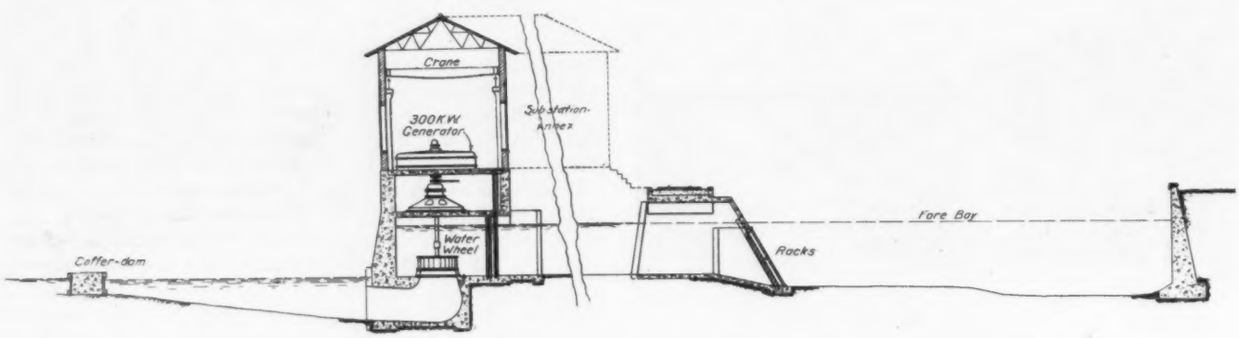


Fig. 5—Cross-Section of Proposed Hydroelectric Station at Marseilles.

Running east from Marseilles to Seneca and Morris and West to Ottawa, Utica and La Salle there is an unusually interesting 33,000-volt, three-phase, 60-cycle transmission line. The poles for this line were made of reinforced concrete and set along the bank of the old Illinois and Michigan Canal, which runs parallel to the Illinois River, and passes through the Illinois River towns which will receive electrical energy from this new hydroelectric plant. This transmission line is about thirty-six miles long a part of it having been in use for the last three years. The concrete poles are from 30 ft. to 60 ft. long, with 6-in. square tops, and in the case of the 30-ft. poles, 9-in. square at the base. The 30-ft. poles are reinforced throughout their entire length by six 0.5-in. square steel rods. The poles are designed to carry two 10-ft. wooden cross-arms and are spaced 125 ft. to 132 ft. apart. At present they carry three No. 4 hard-drawn copper wires. The cross-arms and braces are attached to the pole by galvanized iron through-bolts inserted in holes cast in the concrete. Fig. 6 shows a portion of this concrete-pole line at Ottawa.

It is expected that the entire development here described will be completed and ready for service by Aug. 1, 1911. Mr. C. W. Humphrey, of Chicago consulting and designing engineer, has been retained to execute the engineering work.

ILLUMINATION OF A NEW YORK DEPARTMENT STORE.

Extensive Use of Tungsten and Tantalum Incandescent Lamps in the Gimbel Brothers' Establishment.

Early this morning the large department store of Gimbel Brothers, situated at the corner of Broadway and Sixth Avenue, New York City, was opened for the transaction of business. The building, which is an eleven-story fireproof structure, occupies the half of the block running from Thirty-third to Thirty-second Street on Sixth Avenue immediately in front of the new Pennsylvania Railroad Terminal and is in close proximity to other immense department stores on and within a radius of a few hundred feet of Herald Square. Over twenty-six acres of floor space are provided for the 390 departments

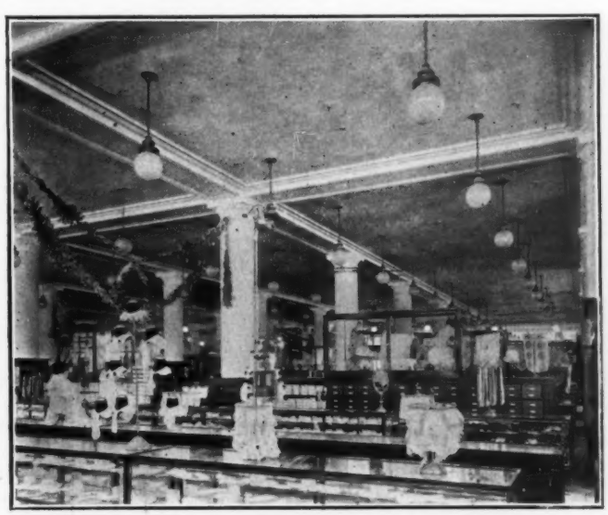


Fig. 1—Corner of Main Floor.

in the store, and in addition to 908 showcases there are forty-five show windows of very large proportions in which to display goods. Advantage is taken of every labor-saving device known in department store work. Thirty-six passenger elevators and ten freight elevators are available for use, and for small parcels two double-blade spiral conveyancers, running from the roof to the sub-basement, and eight electric conveyances reach all parts of the building. Eight telephone operators are employed to attend 1020 stations, and seventeen miles of pneumatic tubes, with 370 stations, are employed in the cash transfer system. In wiring the building over 540 000 ft. of wire in conduit was utilized, requiring the services of forty men for thirty weeks.

Fig. 2—Tungstens with Opalescent Shades on Seventh Floor.

For supplying the large connected lamp and motor load in the building, which aggregates approximately 10,000 hp, the New York Edison Company has erected a substation in the sub-basement. The equipment being installed consists of seven 1000-kw rotary converters with the necessary step-down transformers and high-tension switches. Three-phase, 25-cycle alternating current at a tension of 6600 volts is brought underground from the Waterside Stations, and this is converted to direct current at a potential of 240 volts for the three-wire system in the building. A direct-current switchboard is located in the sub-basement and tied with the building distribution board by heavy tie connections. Ultimately there will be several 1,000,000 circ. mil concentric cables feeding out into the Edison distribution mains so that in case of trouble with the substation apparatus these feeders will supply energy from the street service to the building, ensuring continuity of service under all conditions.

With the exception of the showcases the entire structure is illuminated by tantalum and tungsten incandescent lamps. The showcases are fitted with 8-cp and 16-cp tubular carbon-filament lamps, because the newer types of lamps are not made in

Fig. 3—Individual Reflectors with Tungstens in Art Gallery.

that form. Altogether there are approximately 7000 tungsten and 900 tantalum lamps in the installation, ranging in rating from 25 watts to 250 watts.

The Gimbel installation is the first of its kind; that is, the first where a distributive system of lighting has been designed and carried out. The floors of the building are laid out in bays, there being 152 bays having an area of 21 ft. by 23 ft.

2 in. The wiring is designed so that one switch controls on the main floor two outlets in each bay, there being four outlets allowed to each bay throughout the structure. On the floors above the first one switch controls four outlets.

On the first floor there are four 250-watt clear-bulb tungsten lamps to each bay, and these are equipped with a 12-in. sand-blasted ball attached to the ceiling by a chain fixture hanging approximately 4 ft. from the ceiling, bringing the bottom of the lamp about 13 ft. 6 in. from the floor. Each of the ceiling outlets on the second and third floors is equipped with 150-watt clear-bulb tungsten lamps used with sand-blasted balls of smaller size than those used on the first floor.

The fourth, fifth, sixth and seventh floors are equipped with 100-watt frosted-tip tungsten lamps with reflectors of the opal and prismatic glass type having open bottoms, and the latter reflectors are satin-finished. The eighth floor is equipped with 60-watt clear-bulb tungsten lamps in sand-blasted balls, not much light being needed, as the concert hall and dining-room are located on this floor. The ninth and tenth floors are equipped similarly to the fourth, fifth, sixth and seventh floors with the exception that 60-watt tungsten lamps are used.

The staircases are lighted by 25-watt and 40-watt tantalum lamps with open bottom reflectors. In the toilets, locker-rooms and paper chutes 40-watt plain-bulb tungsten lamps with open bottom reflectors are employed. In these cases, however, 40-watt tantalum lamps will undoubtedly be used hereafter, as not much illumination is required.

The average intensity of illumination throughout the building is approximately from four to six foot-candles, the highest intensity being on the fifth and sixth floors, where the light flux density is approximately six to eight lumens per square foot, while on floors where sand-blasted globes are used the intensity drops from two to four foot-candles. This loss is caused by absorption through the form of glassware used, illumination being subordinated to artistic effect.

The show-window lighting of the Gimbel store is most effective and economical. The outlets are placed on the ceiling where window glass and ceiling form an angle and are spaced approximately 1 ft. apart. Each outlet is equipped with either a 60-watt or a 100-watt tungsten lamp, depending on the goods displayed the larger unit being used when dark articles are shown. Each lamp is equipped with a specially-designed individual steel reflector of the Holophane-d'Olier type with holder that can be adjusted to accommodate either size of lamp, so that the reflector is brought in proper relative position to the filament of the lamp. The reflector directs the light flux in the most useful direction, the lamps being individually treated and the reflection being specific rather than general.

Fig. 4—Arrangement of Lamps on Third Floor.

Fig. 6—Corner of Restaurant.

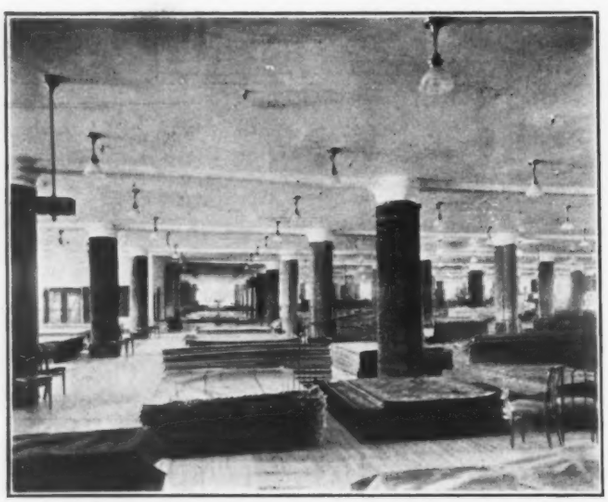


Fig. 5—View of Sixth Floor.

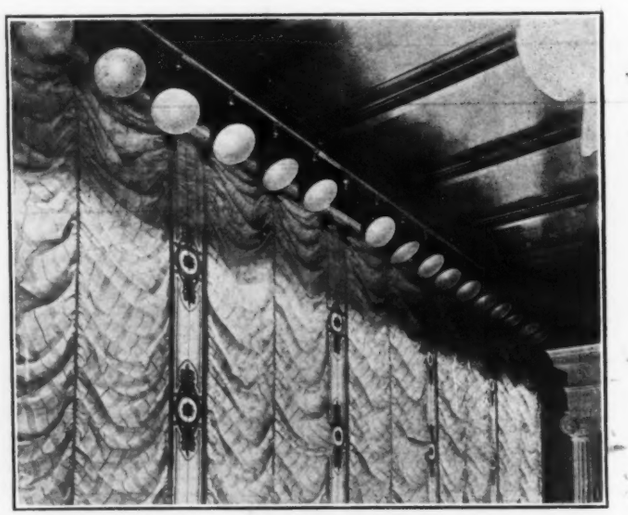


Fig. 7—Arrangement of Lamps in Show Windows.

THE DEVELOPMENT OF THE WAVE-METER IN WIRELESS TELEGRAPHY.

BY GEORGE SEIBT.

DURING the last six years wireless telegraph experts and physicists have been very active in the development of high-frequency apparatus and the perfection of methods for measuring and investigating electric waves. At present there are many methods and instruments suitable for studying electric waves, and the art of measuring has approached a degree of perfection equal to that usual in the measurement of low-frequency currents. The work which led to the present success is largely due to German engineers and physicists, among whom may be mentioned Zenneck, Wien, Drude and many of their pupils, while in certain circles in the United States much attention has been given to the purely commercial development of wireless telegraphy.

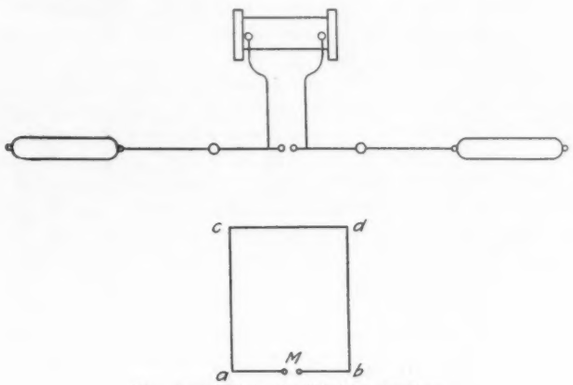


Fig. 1—Hertz's Oscillating System.

The beginning of electric wave measurement dates from the first experiments with electric waves. Hertz in his experiments employed devices which enabled him to measure in a rough way the wave length. In his writings on the velocity of propagation of electric waves[1] he describes, among other things, the method shown in Fig. 1. An oscillating system connected with an induction coil produces electric waves of a definite period, and transmits them inductively to a receiver made up in the form of a wire quadrangle, *a c d b*, which, by means of a spark micrometer, is used to detect the maximum amplitude of the potential. By changing the length of the different wires Hertz obtained the curve shown in Fig. 2. The marked maximum he explained as a resonance phenomenon. If in his time it had been known that the transmission of waves on good conducting wires takes place at the same velocity as in the air, Hertz would have been able to determine directly the frequency of his oscillator. Since his wire quadrangle oscillated in a half wave length with the potential node in the middle and the maximum amplitude at the spark micrometer, the wave length determined in this way is $\lambda = 8.8$ m, and the frequency, assuming a propagation velocity of $V = 3 \times 10^{10}$ cm per second, is $f = 3.41 \times 10^{7}$. Although Hertz worked with frequencies which are much higher than those now used in wireless telegraphy, his experiments deserve especial praise, as the resonance phenomena noted by him are the basis upon which all wave meters now used in practice are founded.

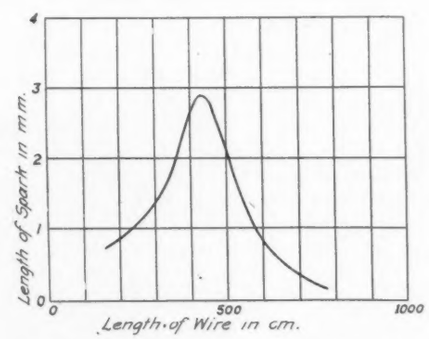


Fig. 2—Relation of Spark to Length.

A notable step in the progress toward a practicable wave meter was made by Lodge in his studies of electric resonance, or "syntonics" as he called it. Instead of the open oscillating circuit which was used by Hertz, Lodge utilized the closed circuit, and in this way larger amounts of energy were present and resonance effects were more marked. From his apparatus a sort of standard form of demonstration apparatus for lectures has been developed.[2] Fig. 3 shows a schematic diagram of Lodge's apparatus. Two equal Leyden jars, *A* and *B*, are connected in circuit by heavy wires, the parts *a* and *b* forming bridges which may be moved to or from the jar. The system in which the oscillations are generated contains the spark-gap *F*, and the resonator is provided with a tinfoil strip *S*, which is connected to the inner layer of the Leyden jar, carried over the top of the jar and brought in close proximity to the outer layer. When oscillations are produced in system I, by induction the wire quadrangle in the second system is traversed by a pulsating magnetic field, which produces oscillations in system II, the magnitude of these oscillations depending on whether or not the natural period of the receiving system coincides with that of the oscillations. In case of resonance, system II will be set into violent oscillation and the gap between the tinfoil and the outer layer of the Leyden jar will be broken down. By adjusting one of the bridges *a* or *b* the conditions of resonance may be attained.

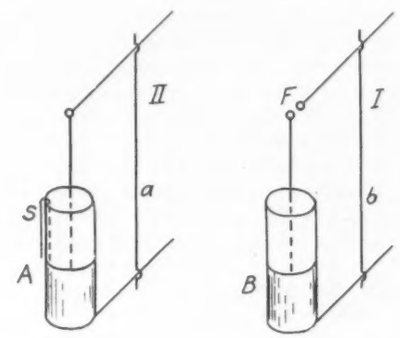
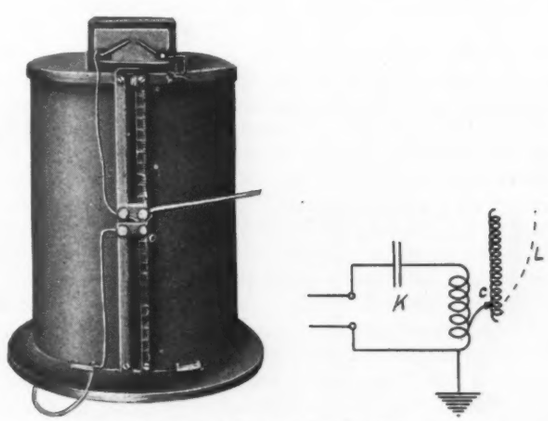


Fig. 3—Diagram of Lodge's Demonstration Apparatus.



Figs. 4 and 5—Frequency Meter.

Thompson and Kirchhoff have developed the mathematical theory which applies to the frequency and wave length of oscillations produced with Lodge's apparatus. According to

[1] H. Hertz: *Ann. d. Phys.*, Vol. XXXI, p. 421, 1887.

[2] Lodge: *Nature*, Vol. XLI, p. 368, 1890.

them, the frequency is $f = \frac{1}{2\pi\sqrt{CL}}$, and the wave length in air and good conducting wires is $\lambda = 2\pi\sqrt{CL}$, in centimeters, where L and C are both measured in centimeters.

A very rigorous mathematical theory of the phenomena occurring in secondary circuits was later developed by Bjerkness[3], in which formulas are given for the maximum potential across the condenser, thermal effect and the effect of the potential across the condenser and its dependency on the frequency and the damping coefficient. This work was made the basis for the determination of damping and frequency, and Bjerkness, in addition to the mathematical treatment, published a number of measurements made on damped oscillations produced in his experimental apparatus.

Along with the closed circuit oscillator there is another form of resonator which is identified with the names of Tesla,[4] Slaby[5] and Seibt,[6] and which for the measurement of waves was of passing importance. The form referred to is the coil type shown in Fig. 4. If a coil wound on a glass core is connected to a generating circuit and a contact arranged so that the length of wire in the coil can be varied, there is a definite position of this contact for each wave-length, which is recognized by a lively discharge at the top of the coil. In this position the length of wire represents a quarter wave or a multiple thereof.

Fig. 6—Coil Details.

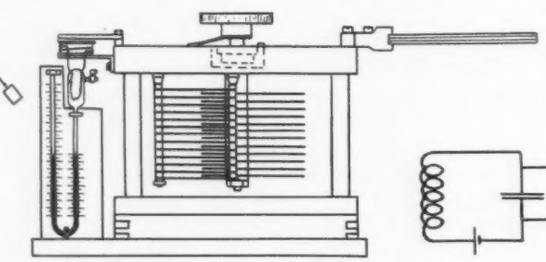


Fig. 7—Franke-Doenitz Apparatus.

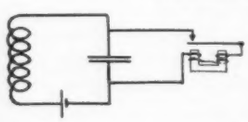


Fig. 8—Eichborn Apparatus.

Scheller and Count Arco[7] were the first to build a frequency meter on this principle and make measurements with it in a practical sending station. Fig. 4 shows their apparatus. The turns of wire were covered by a hard-rubber sleeve, except along the path of the adjustable contact. The spark discharge was observed on the needle gap at the top of the coil, and the length of wire connected in circuit was read directly from a scale over which the contact played.

The results obtained with this tuning coil could be considered as giving only an approximate indication of the wave-length. Owing to the difficulty of accurate observation, the secondary effect of the resonator upon the sender and the indefinite capacity of the coil, this type of wave meter was not successful.

The author demonstrated some eight years ago the marked effect of the surroundings on indications obtained with this coil form of meter.[8] Experimenting with an arrangement such as shown in Fig. 5 the point of resonance with a given train of waves could be varied over a wide range by simply approaching the hand or a sheet of tinfoil to the coil.

These experiments demonstrated that an oscillating system which could be used for measurement purposes must possess a sufficiently large capacity to render the influence of neighboring objects negligible. This requirement was met even to a lesser degree by Slaby's so-called multiplication coils[9] than was the case with Scheller and Count Arco's coils. The Slaby coils had the advantage of being more easily transported, cheaper to build and of greater sensitiveness than the Scheller and Arco apparatus. In Fig. 6 the construction of one of the coils is shown. The principal parts are a glass tube, around which many turns of very fine wire are placed; a contact point, which can be moved up and down over the turns, and a thin sheet of chemically-prepared (barium-platinocyanide) paper which is rubbed with goldfoil and fastened to the point of the contact. When the excitation reaches a sufficiently large value, a green light appears on the paper screen, which indicates the maximum resonance.

Resonance coils can be considered as inapplicable to wave measurements. They have never come into extended use, not only on account of the lack of accuracy of the measurements, but also on account of the amount of time required to make the adjustments, which in practice is a very serious objection. Engineer Doenitz[10] produced an excellent scheme which pointed the way to a successful solution of the problem. Fig. 7 shows a sketch of the Franke-Doenitz apparatus, which consists principally of an adjustable plate condenser of the Koepsel type, three coils of different inductance, and a Riess air thermometer in which the position of a column of colored alcohol indicates the heat effect produced. The plate condenser is made up of two systems of semi-circular plates, one system being fastened rigidly and the other arranged to rotate between the first ones. The air thermometer is in a special circuit, which is loosely coupled to the measuring circuit. Adjustment of the wave-length is attained by means of the inductance coils and the condenser in combination. The inductance coils are used for large steps, and the condenser for gradual and fine adjustment.

The great advantage of the Franke-Doenitz wave-meter as compared with the resonance coil lies in the use of quantitative apparatus and a large condenser, which latter guards the apparatus from the influence of the surroundings. By means of this instrument not only could the resonance maximum be determined, but the resonance curves could be plotted and the damping of oscillating circuits determined.

Between the years 1903 and 1906 the Doenitz wave-meter ruled the market, but in time the large, heavy plate condenser immersed in oil gave trouble, and the sensitiveness of the air thermometer was no longer satisfactory. At about this time Dr. Eichborn in Zurich developed a method[11] of producing slightly damped oscillations which possessed great possibilities as a method of wave measurement.

The principle of this apparatus is shown in Fig. 8. The oscillation circuit includes a source of energy and an interrupter connected in parallel with a condenser. When the circuit is opened a train of slightly damped oscillations is produced. What takes place in this system of circuits is similar to the surges that occur in an ordinary electric system when the current is suddenly interrupted. If at the time of interruption the current in the circuit is I_0 and the potential across the condenser is E_0, the wave is represented by the equation

$$E = l^{-\alpha t}\sqrt{E_0^2 + \left(\frac{I_0}{\omega C} - \frac{\alpha E_0}{\omega}\right)^2}\cos(\omega t - x)$$

It is of great importance to smooth operation that the interruption of the current take place quickly and without spark at the contacts. This latter condition can easily be attained by using large condensers in parallel with the windings of the interrupter magnets.

With the principle of the Eichborn apparatus in mind, the Franke-Doenitz wave-meter, under pressure of the requirements of practice, was thoroughly overhauled and the construction greatly modified.

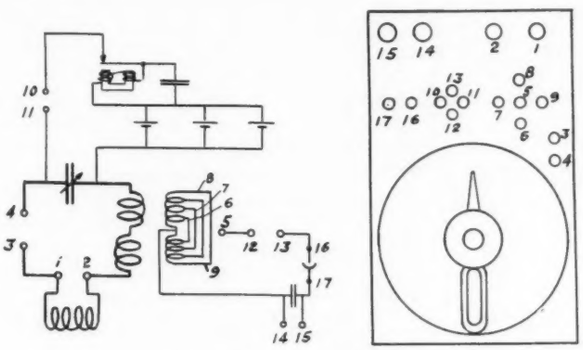
The Gesellschaft für Drathlose Telegraphie in Berlin brought out its so-called station tester, in which, among other novelties, use was made of the Hartmann & Braun hot-wire instrument instead of the air thermometer.

The C. Lorenz Company, of Berlin, and Mr. Hahnemann

[3] *Wied Ann.*, Vol. LV, p. 121, 1895.
[4] "Inventions, Researches and Writings of Nikola Tesla," by T. C. Martin.
[5] Slaby: *E.T.Z.*, p. 38, 1901.
[6] Seibt: *E.T.Z.*, p. 586, 1901; p. 105, 1903.
[7] Arco: *E.T.Z.*, p. 6, 1903.
[8] Seibt: *E.T.Z.*, p. 105, 1903; *Phys. Zeit.*, No. 2, 1903.
[9] Slaby: *E.T.Z.*, p. 1008, 1903.
[10] Doenitz: *E.T.Z.*, p. 20, 1903.
[11] German patent No. 157,056.

built a testing outfit provided with auxiliary apparatus and devices for making various connections, which was especially well adapted to measurement of undamped oscillations. The Marconi Company, it is rumored, has lately given up the Flemming cymometer, and has adopted a wave-meter involving a closed oscillating circuit, which includes a plate condenser of adjustable capacity.

It is not the purpose of this article to go into details of all these constructions. The modern views on the construction of



Figs. 9 and 10—Seibt Apparatus.

wave-meters may be sufficiently well set forth in the description of an instrument which the author designed for the Radio-Telephone Company, of New York, and which is now in extensive use in the United States. In the opinion of the author this apparatus has the following advantages over the above-mentioned constructions: In spite of its wide adaptability, its manipulation is exceedingly simple and the possibility of errors of any kind is remote. When constructed as a calibrated resonator it has a sensitiveness such as was heretofore unknown, and can therefore be used for observing the powerful waves of the sending station as well as the incoming waves. The calibration is given directly in wave-lengths, and is the same whether operating as a sender or a receiver, so that no corrections need be made.

The uses to which it can be put are as follows: (1) In the erection of a station it may be used to tune the antennæ and the primary oscillation circuit to the desired wave-length. (2) When operating as a calibrated sender it serves the purpose of tuning the receiving apparatus to the determined wave-length.

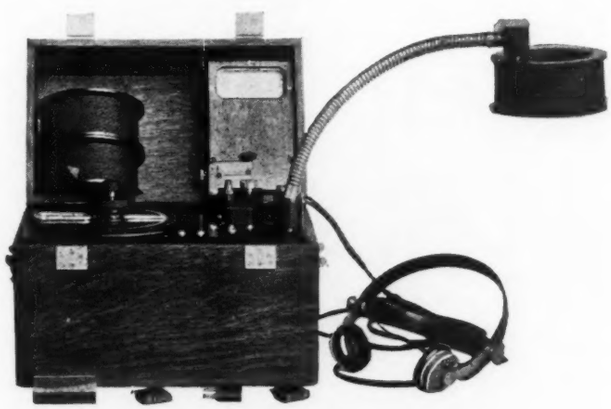


Fig. 11—Seibt Apparatus.

When a number of oscillations of different wave-lengths are to be received it may be used to calibrate the apparatus in wave-lengths. (3) Upon completion of the station it serves as a control of the sender and receiver. (4) In scientific laboratories it is suited to the investigation of electrical properties of oscillation systems, for the taking of resonance curves, for the determination of the degree of coupling and the damping coefficient of circuits.

The instrument consists primarily of a closed oscillating circuit with a continuously adjustable capacity and a step-by-step adjustable inductance. The additions which must be made to this oscillating circuit depend upon the use to which the instrument is to be put; for instance, whether or not it is to be used as a wave-meter for the reception or production of oscillations, what length of waves it is to measure and what degree of sensitiveness it is to have. Fig. 9 shows the complete circuit diagram. Fig. 10 gives a top view and Fig. 11 shows the actual appearance of the apparatus in its commercial form.

When in use the flexible arm is inserted in the holes 1 and 2, and to the plug on the end of the arm is fastened one of the three-wire inductance coils which are wound upon hard-rubber cores. The three inductance coils give three overlapping ranges of measurement corresponding to the following wave-lengths: $\lambda = 200$ to 600, $\lambda = 450$ to 1300, and $\lambda = 1000$ to 3000 respectively. The contacts 3 and 4 are short-circuited with plugs whenever wave-length measurements are being made.

When the wave-meter is to be used as a generator of oscillations, 10 and 11 are connected through a short-circuit plug, whereby an automatic interrupter contained within the case is set into operation, and with each interruption of the current slightly damped oscillations are produced.

When the wave-meter is to be used as a resonator the following operations must be performed: (1) Contacts 12 and 13 are connected by a short circuit plug. (2) To 16 and 17 a detector is connected. (3) Contact 5 is connected by a plug with either 6, 7, 8 or 9, according to the degree of sensitiveness desired. (4) 14 and 15 are connected to a telephone receiver or a pocket galvanometer, according as it is desired to adjust the instrument by means of hearing or sight. However, both the telephone and galvanometer may be connected either in series or parallel. One of the two detectors is a standard Radion detector, consisting of a thin, adjustable brass contact point and a lead sulphate crystal as a second electrode. The other form of detector is much more sensitive, and is made up of a thin platinum wire, which is fastened on one side to two lead-sulphate crystals, and on the other side between two brass plates. As a precaution against the gradual action of the oxygen in the air, the crystals are covered with a coating of paraffine.

The indications of the pocket galvanometer when used with the lead sulphate detector are not exactly proportional to the square of the current. In damping coefficient measurement, therefore, it is necessary either to use a curve which gives the relation between the square of the current and the deflection of the galvanometer, or to substitute for the latter an instrument which gives indications that are truly proportional to the heating effect of the current, such, for instance, as a thermocouple, bolometer or hot-wire instrument. According to Zenneck's simplified expression of Bjerkness's formula, and with the resonance curve, the sum of the decrements of the sender and receiver is given in the following formula:

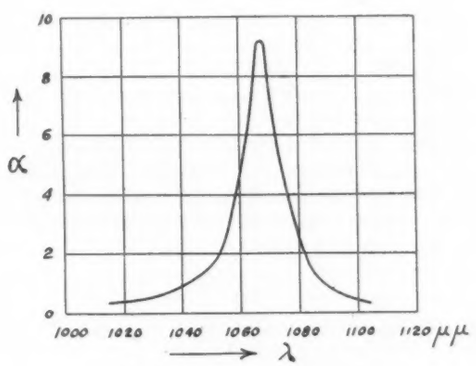


Fig. 12—Resonance Curve.

$$\delta_1 + \delta_2 = \frac{\pi (\lambda_1 - \lambda_2)}{\lambda_r} \sqrt{\frac{a}{a_r - a}}.$$

The separation of the two decrements is accomplished by introducing into the resonant circuit a known resistance, which increases the decrement by a calculable amount, δ_2; and if the deflection of the instrument is now a_r the decrement of the circuit is expressed by the formula

$$\delta_2 = \delta'_2 \frac{a'_r \left(1 + \frac{\delta_2^2}{\delta_1 + \delta_2}\right)}{a_r - a'_r \left(1 + \frac{\delta_2^2}{\delta_1 + \delta_2}\right)}$$

The simplest formula for expressing the increase in decrement is the following:

$$\delta_2^2 = 6.58 \times 10^{-5} \frac{CR}{\lambda}$$

wherein C is in centimeters, R in ohms and λ in meters. In order to provide for these determinations, the wave-meter is accompanied by a calibration curve for the capacity in centimeters, and three resistors having a resistance of 3 ohms, 6 ohms and 12 ohms respectively. When making measurements the resistances are inserted in the holes 3 and 4, as shown in Figs. 9 and 10. The material of the wire for the resistor is so chosen that no noticeable skin effect occurs. The inductance and capacity of these resistors can likewise be neglected. Fig. 12 shows as an example a resonance curve made with this wave-meter. Employing the method outlined above, the damping coefficients of this wave are found to be $\delta_1 = 0.0149$, and $\delta_2 = 0.0287$.

NATURAL AND FORCED AIR CIRCULATION ACROSS SPARK-GAPS.

A matter that is receiving a great deal of attention in the wireless field is spark-gap ventilation. The advantages a spark-gap across which an air blast is caused to circulate has over one that depends only on natural ventilation may not be generally known, but if properly tried it will be found to increase greatly the efficiency of a wireless transmitter. There are various means of accomplishing this, and one that has been found to work to good advantage is shown in the diagram and may be described as follows:

The gap proper consists of two zinc disks, each 1 in. in diameter and ⅝ in. in thickness. The top disk is drilled neat to take a 3/16-in. machine screw and counter-sunk, as shown by the dotted lines in the diagram, so that the screwhead will be flush with the sparking surface. The disk is screwed to the regulating stud which passes through a sleeve in the top of the casing. The lower disk has a shoulder turned with a slight taper so that it will fit snugly into a piece of ⅝-in. brass pipe about 6 in. in length. From the top of the disk six holes are drilled, the ones near the circumference being drilled at an angle so that all will converge within the shoulder.

At the other end of the brass pipe, which is threaded, an elbow is attached and to this a piece of rubber hose, which is connected to a blower, the one used in the case described being a ¼-hp, 2300-r.p.m. Sturtevant machine. A resistance was put in series so as to reduce the speed to 1800 r.p.m., as this produced the best pitch of spark.

The blower was so connected that it started automatically with the starting of the transmitting motor-generator set and was placed outside the operating room so that the noise of its running would not interfere with the receiving of signals.

One of the advantages of an air blast across a spark-gap is that it keeps the spark-gap cool and at a practically uniform resistance which will allow the transmitter to be used indefinitely without the spark varying in pitch or the necessity of having either to shorten the gap or increase the power in the primary circuit due to the I^2R loss in the heated oscillating circuit. Gases formed by the oxidation of the air and metal and which allow brush discharges of lower potential to pass and give varying and rough notes in the spark are dispersed, and by causing a clearer note and giving the spark a higher pitch the signal may be read more readily, especially through interference and atmospheric disturbances.

The writer has had occasion to install a blower across two different spark-gaps and in each case the efficiency of the transmitter was greatly increased. This was especially noticeable with one set on a ship where it was necessary to transmit daily with the utmost power available (in the case cited, 3½ kw) as

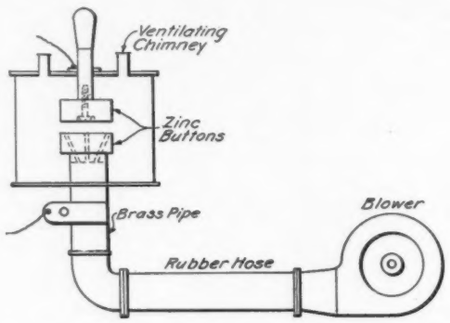


Fig. 1—Diagram of Spark-Gap Ventilating System.

many as 20 to 30 messages of considerable length to distances varying from 200 miles to 1100 miles. The spark did not heat or break or give the least particle of trouble. When used up the disks are readily removed and can be replaced by new ones.

An air blast is particularly applicable to spark-gaps which are enclosed on account of the noise made when transmitting. In open or non-enclosed gaps a scheme which has worked extremely well is shown by the photograph and can be readily understood.

The main spark-gap is composed of two identical gaps con-

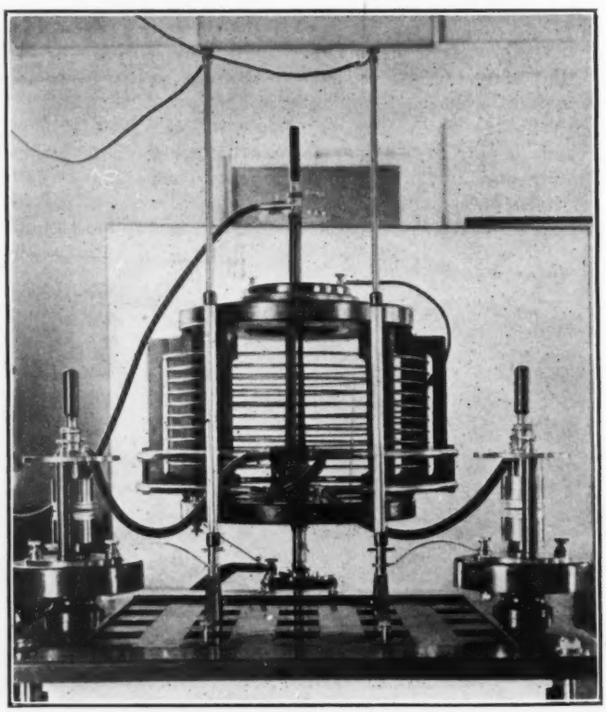


Fig. 2—Two Spark-Gaps in Series.

nected in series with the condenser and the primary of the inductive coupling. These are of much larger diameter than usually found on a wireless transmitter. Each gap is made up of zinc rings 2¼ in. in diameter and rounded on the sparking surface. The inside of the rings in the upper gaps is cup-shaped and solid, while the lower gaps have holes drilled inside the

rings so that when the sparks are oscillating the heated air rising causes cool air to come up through the holes and circulate across the gap. The great amount of sparking surface also helps greatly to limit the heat. Owing to the capacity of the disk or ring the gap cannot, of course, be separated nearly as far for the same potential as would be the case if the discharge were across points.

Another form of self-ventilating gap is the revolving synchronous gap used in the high-frequency Fessenden transmitter. This type of gap consists of a large revolving, insulated disk directly connected to the shaft of the alternator. On the periphery of the disk, set in a brass band, are spokes the same in number as the field coils of the alternator and the discharge takes place between these spokes and two adjustable stationary members set on either side of the revolving disk to which the condenser terminals are attached. As these alternators revolve at a rate of speed of about 1500 r.p.m. the windage set up, and consequently the circulation of air across the spark-gap, is considerable.

RECENT STREET-LIGHTING CASES IN MASSACHUSETTS.

One of the most important duties of the Massachusetts Gas & Electric Light Commission is the adjudication of petitions in connection with central-station rates and service. Chapter 121 of the Revised Laws of the commonwealth provides in Sec. 34 that upon the complaint in writing of the Mayor of a city or the selectmen of a town in which a company engaged in the manufacture or sale of gas or electricity for light or heat is located, or of 20 customers thereof, either of the quality or price of the gas or electric light sold and delivered, the board shall notify the company and after a public hearing may order any reduction in the price of gas or electric light or improvement in quality, and that the maximum price fixed by such an order shall not be exceeded except as provided in Sec. 35. The latter provides that a gas or electric light company may apply to the board to fix and determine the price of gas or electricity to be thereafter sold by the company, and the order of the board, reached after public hearing of all parties in interest, is binding until superseded by a further order.

Among the matters which have been brought before the board under the foregoing chapter, street-lighting rates frequently appear. During the past decade the board has had occasion to discuss street-lighting questions at more or less length, sometimes in connection with petitions concerned directly with rates and service for the illumination of the public thoroughfares, and at other times in connection with petitions asking for a general reduction in rates. A résumé of the more important utterances of the commission in relation to electric street lighting is useful. The board has had jurisdiction in this field for upward of twenty years, but at the present writing only the cases of the past ten years will be reviewed, and as reflected in the decisions of the commission.

FITCHBURG PETITION, 1900.

This was a complaint of customers of the Fitchburg Gas & Electric Light Company relative to the price of gas and electric light. The case concerned commercial arc lighting, gas supply and street illumination. At the time the company supplied arc lights of 1200 nominal candle-power for both street lighting and commercial purposes. There were 265 street lights, operated on an all-night and every-night schedule, at a price of $110 per lamp per year. The population of the territory was about 31,000. In considering the petition the board made a careful study of the operating expenses, capital and depreciation charges. The important question in the case was the relation of plant value to capitalization. Economy in management and a conservative administration had enabled the company to apply to the development of its gas plant considerable portions of its income which under a different policy might have been paid in dividends. The board points out in its decision that "in this way the gas plant has attained a high value relative to the actual capital issued upon it, and upon such capital a higher return than would be otherwise permissible may be allowed without prejudice to the public interest." Regarding the electric plant, the board found that the great advances in the art of electric lighting and the peculiar conditions surrounding the business in Fitchburg had combined to cause a large reduction in the plant value. It was evident that a thorough reconstruction of the electric plant was necessary to furnish a satisfactory public service. Prior to the assumption of the electric business the company had been earning and declaring dividends of 10 per cent per year. It continued this rate without interruption upon the entire capital invested in the electric plant. The board found that the company had not realized the effect of this dividend and the maintenance charges upon the prices, and that "the more nearly even relation between the electric plant and its capital seems to justify only a moderate dividend upon the latter," and that a reduction of the general dividend upon the entire capital and the charges for maintenance would open the way for the further reductions in price recommended. In this case the price of street lights was reduced to $100 per year.

WALTHAM PETITION, 1901.

As in the Fitchburg case of 1900, the Waltham case was not primarily of interest on account of street lighting, but in the course of a petition of the Mayor of Waltham against the Waltham Gas Light Company for lower prices of gas and electricity the resulting inquiry by the board disclosed the fact that a very large difference existed in the price per unit of energy to the city and to private customers for electric arc lights. These charges were about 10 cents per kw-hour to the city and approximately 16 cents to private consumers. The board referred to this matter in the following significant language:

"It seems to have been assumed by the company and the city that the latter was entitled to a concession in rates, perhaps even to the full amount that has been made. Whether the city is justified in claiming and the company in allowing so large a differential is perhaps difficult to determine. This board, however, has no authority to require the rate to be increased, even if it be clear that it be unfairly low. Any such adjustment can only be reached by agreement between the parties. Since, however, the entire income, even with a fair price for power, promised to return the company little if any more than a fair profit, the board did not see its way clear under the existing conditions to require a reduction in the price of street lights, and was able to recommend only moderate reductions in the prices for commercial lighting."

NEWTON PETITION, 1901.

This was a petition by the Mayor and consumers of the City of Newton complaining of the price and quality of gas and electric lights supplied by the Newton & Watertown Gas Light Company. The municipality served had a combined population of about 50,000 and covered an area of about 60 square miles. The territory was largely a residential district. About 75 per cent of the total electrical output was for street lighting only. There were in service 222 arc lamps of 1200 nominal candle-power on all-night and every-night service at a price of $100 per lamp per year. There was also incandescent service running until 12:30 a. m. The investigation showed that the service could be improved by more frequent renewals of street lamps, quicker attention to temporary troubles, and increased generating and distributing plant capacity. The company took the service in hand at once. The interesting feature of the case was the influence of the street-lighting business. This returned to the company only about 40 per cent of the entire electric income; and the rate per unit received for the electrical supply to street lights was less than one-half that received for commercial lights. In its decision the commission stated that it was unnecessary in this instance "to determine the

vexed problem of how large a differential, if any, should be allowed in the price to the municipality for its use, as compared with the price to private consumers (the italics are writer's), *but the board cannot approve a policy by which the rates for municipal use are made so low as to impose upon private consumers the entire burden of the investment charges.* The prices secured by the city are by agreement with the company, and this board has no authority to increase them, even were it thought desirable to do so. Any adjustment of such a condition seems to be left by statute to mutual agreement between the parties. It appears to be a fact, however, that so large a portion of the gross profit comes from commercial lighting that the return realized by the company upon its investment for the street lighting business is at a less rate than the interest paid upon its loans. While the present conditions continue the board cannot see its way clear to require a reduction in the electric lighting rates either for street or commercial purposes."

WORCESTER PETITION, 1901.

In this case the Mayor of Worcester complained of the prices charged for electric street lights by the Worcester Electric Light Company. At the time there were about 700 arcs of 2000 nominal candle-power in service on the all-night and every-night basis, at a price of 32 cents per lamp per night. The company offered to supply these under a five-year contract upon a sliding scale from 31 cents the first year to 30 cents for the last year. The city contended that the company should make a lower price, that it could well afford to do so, and that such lights ought to be supplied to the municipality at net cost, and without profit. The company was one of the most prosperous in the State, and had acquired exceptional ability for performing its duty to the public. Its accumulated surplus enabled its business to be carried on with greater economy and its product sold at the same rates as in other cases, or lower, with a more liberal return upon the investment. The board's discussion of this case was most interesting, and its final paragraphs are quoted as follows:

"Perhaps the most important question involved in this case is how far the public may properly share in the benefits which this prosperity makes possible. What the corporation has already earned and saved it has a right to retain. It is its own property, and there is no law, nor any principle receiving general public approval, by which its surplus can be directly diminished for the purpose of selling at less than a fair profit.

"But it must not be forgotten that, however wise and skilful may have been the management, the company has been able to acquire its present accumulations only by the exercise of a monopoly which it has enjoyed by the favor of the State, and which is, in a measure, assured to it by law. This is certainly a most important contribution by the public to the company's prosperity, for which the public is entitled to special consideration. When both parties have so contributed to these results neither ought to claim the exclusive right to the benefits they confer. These conditions impose upon the company a duty to share these advantages with the public, if not as a matter of legal right, yet as a sound public policy. Such a division of them will be to the company the surest guarantee of the continuance of its monopoly, just as the public interest will be most surely promoted by a ready recognition that a portion of them belongs to the corporation. The reasonable price to be charged is therefore not to be determined by prices which may be paid elsewhere to other less fortunate companies, but is to be one which this company, with all its facilities and advantages, may reasonably be required to make.

"We cannot, however, require such a division of profits to be carried so far that any portion of the company's product should be sold at mere cost, without profit, even to the municipality. . . . (Newton & Watertown italicized decision cited.) . . . In the present case, the investment necessary to do the distinctive work of the municipality, the lighting of its streets, constitutes a large proportion of the entire construction expenses of the company. This investment expects a return; it is made for that purpose; it is clearly entitled to it. If this be not paid for by the municipality, it must be paid by the private consumers. The lighting of the streets is a general public benefit, or it ought not to be done from the public purse. The municipality is no less able to pay a fair price for what it receives than are private consumers. The 1000 customers of this company have as much right to demand that the entire burden of public lighting shall be borne by the 13,000 property taxpayers of the city as the latter have that any portion of it shall be borne by the customers of the company as such. Nor is the opposite contention sustained by the mere fact that the company in a peculiar way occupies the streets by permission of the municipality. Authority for this is granted by the State not for the purpose of revenue to the city, but because it seems to be the only practical way of securing to the city and its citizens one of the great conveniences, a necessity, it may be, of modern life in the most economical and satisfactory way. The corporation is bound, in common with all other citizens, to pay its proportional share for the support of the government, to perform its work in a way that shall interfere in the least possible degree with the public convenience, to directly reimburse the municipality to the last dollar for any expense imposed upon it, and to render the public service for which it is created to the city and all the citizens who may desire it in the best manner and at the lowest reasonable cost. These duties fully performed, it is doubtful if the company has any other. This position, however, does not necessarily conflict with the claim that the municipality may be entitled to some differential advantage, as compared with private consumers generally. The city is the largest customer of the company, and like other large customers has the right to supply its own electric lights if it shall think it advisable to do so; and just as a large private consumer may be entitled to a price as low as he himself could make the light, so the municipality may be entitled to a price as low as it could render equal service with its own plant." The board, therefore, made little reduction, but required the company to put into effect its lowest offer two weeks from the date of the finding.

WAYLAND APPEAL, 1902.

In this case the commission refused the Natick Gas & Electric Company the right to supply street lighting and other service in the town of Wayland, on the ground that the existing service supplied by the company elsewhere was unsatisfactory, and that the Weston Electric Light Company had ample capacity in its plant to supply more than the demands of the territory. The franchise granted the Weston Company in Wayland was sustained.

BRIDGEWATER PETITIONS, 1902.

These petitions were addressed to the board on account of the inability of the town of Bridgewater and the Bridgewater Electric Company to form a street-lighting agreement. As a result of the facts brought out at the public hearing the board was convinced that there was an opportunity for the problem to be solved by a new arrangement by the town as to the number and kind of lamps used. The company's petition requested the board to fix an increased price for lighting, while that of the town complained of the price and quality of the service. The board did not recommend a price, or attempt to tell the town what its lighting should be, but assisted in the negotiations so far as possible, with the result that an agreement was reached between the company and the town. The board stated in its finding that the arrangements had its full approval, and that the conditions were as rigorous and the price as low as the board could impose upon the company. The agreement was accepted by the town and a contract made.

WELLESLEY AND WAYLAND PETITIONS, 1902.

In these cases consumers in Wellesley and Wayland petitioned for an improvement in the quality of electric lighting service supplied in both municipalities by the Natick Gas &

Electric Company. The service was found to be inferior, and the company made plans for its improvement.

QUINCY PETITION, 1906.

This was a petition by customers of the Quincy Electric Light & Power Company for a reduction in the price of electricity and for improvement in the quality of service. In this case the street lighting was not in contention, but it exercised a profound influence upon the company's business. Notwithstanding a relatively high price for commercial lighting, the average price received for the entire output, a factor of great importance in the eyes of the board, was less than 11 cents, which the commission considered "a low price for a company of this size and character," and also pointed out in its decision that the cause is to be found in the arrangement between the city and the company for lighting its streets. The board said:

"More than two-thirds of the company's output and probably an equal proportion of its investment is for street lighting alone. The company's prices for this service have gradually tended downward, until they have reached the point which barely meets the operating cost, with no provision for depreciation, interest, or dividends, and the entire burden of such charges is thus thrown upon the supply for private customers. While the board is unwilling to approve the policy which has brought about these conditions, it has no authority to increase these prices. We are not familiar with the reasons which have led to them, nor are we prepared to say that, having been now reached, they ought to be increased. It is very plain, however, that the facts are of such importance that they control the situation, and that if the price for street lighting were increased a corresponding decrease might be made in the commercial lighting price."

BLACKSTONE PETITION, 1907

This petition was a complaint by the selectmen of Blackstone seeking an improvement in quality and a reduction in the price of street lights supplied by the Blackstone Electric Light Company. The company supplied energy to 38 arc lamps of 2000 nominal candle-power on an all-night and every-night schedule, and 19 street-incandescents. The price of the arc lamps was advanced in 1901 from 38 to 40 cents per lamp per night. The incandescent price was 10 cents per lamp per night. In 1903 the company entered into a contract with the Woonsocket Electric Machine & Power Company for the purchase of all the energy required by the Blackstone company until 1913. The prices to be paid the Woonsocket company were 20 cents per arc per night; for the incandescents, 5 cents, and for energy for commercial incandescent lighting, 6 cents per kw-hour, measured at the town line. There was constant difficulty in earning a dividend out of this business. The only issue was the price of the public lamps. The board found that some such contract as was made with the Woonsocket company was desirable from the viewpoint of the company and the public, but that in this instance the Woonsocket company appeared to be the only party receiving substantial benefits. In the opinion of the board the prices agreed upon were unreasonably high—higher in fact than it would cost the Blackstone Company to produce its own energy in a proper plant. It was apparent that as long as the company is bound by the contract any reduction in the prices of light in force at the time of the hearing would prevent the payment of any dividend. The responsibility for the contract was, however, the Blackstone Company's. At the hearing evidence was offered in behalf of the selectmen for the purpose of establishing the fair cost of supplying the public lamps, and of fixing the price upon the basis of this cost, plus an allowance for depreciation and a return upon only that portion of the company's plant used in supplying the public lamps. The board found that this basis ignored the investment actually made in the entire plant and the income to be derived therefrom in relation to the expense of conducting the entire business. The case called for the fixing of a price which seemed reasonable, taking into account not only what the company was doing or could do as conditions stood, but also what it might fairly be expected to do under proper management. The board ordered the price of arc lamps to be reduced to $130 per year for all-night service, and incandescents to $30 for all-night service. Arc lamps burning until 1 a. m. were fixed at $117, and incandescents on the same schedule at $26. The rates determined applied to arcs of 2000 nominal candle-power and incandescents of 32 cp.

WINCHESTER PETITION, 1908.

The most interesting question in this case was one of alleged discrimination. The selectmen of Winchester petitioned the board for an improvement in the quality and reduction in the price of arc and incandescent lamps used in street lighting, the supply being by the Edison Electric Illuminating Company of Boston. The point at issue was the fact that the company offered the neighboring town of Arlington a 20 per cent discount from the regular rates on condition that a twenty-year street-lighting contract be made. The authorities of Winchester were unwilling to make a contract for more than one year at the time of the petition, and contended that the company was discriminating in favor of Arlington. The board took the ground that before ordering a reduction in rates on this basis it must be convinced that the facts present a clear case of unlawful discrimination. The board said:

"The company's position is distinguishable from an attempt to impose, as a condition precedent to obtaining a supply at all, or except at a price in excess of the regular rate, that a customer must agree not to obtain his supply from any other source for a given period. The latter is plainly an unlawful discrimination, and has been so held by the courts. The ground commonly relied upon against discriminations is that they tend to give undue advantage to those to whom they are made, as against those to whom the same concessions are not offered. But in this case it must be confessed that the discrimination complained of is not offered to one municipality and withheld from another, nor is it conditional upon the number of lamps operated or the quantity of electricity supplied, but is offered upon the same terms to all municipalities willing to make contracts for extended periods. There is no clear weight of authority that a discrimination of this character is unlawful, and for this reason the board is of the opinion that it is not justified in ordering a reduction in price on this ground alone."

The company made the point in this case that inasmuch as the wires and apparatus supplying the street-lighting service were devoted to that exclusive purpose, the possibility that the town might light its streets in some other way and abandon the company's supply introduced an element of risk due to abnormal depreciation which should be provided for in the price charged, but might be minimized by making a long-term contract with the municipality served, in which the reductions in price would be in proportion to the contract life.

CHESTER PETITION, 1908.

Street-lighting rates were incidentally concerned in this petition, which was a prayer of the selectmen of Chester for a reduction in the price of electric lighting and a change in the method of fixing the price. There was no well-sustained complaint respecting the quality of the street lighting. Chester is a small town of about 1300 inhabitants. The business has never been a success, and the board dismissed the petition, with some extended comment upon the disadvantages of employing complex rate-making systems in small communities.

LEOMINSTER PETITION, 1909.

This was a petition by the selectmen for a reduction in the price and quality of electric light and power supplied for both public and private use by the Leominster Electric Light & Power Company. The quality of street-lighting service was somewhat criticised, but as it appeared to the board, no properly accredited effort was made to determine the quality of the street lights, and the board issued no order regarding it. In connection with a general rate reduction ordered, the street-lighting prices were slightly reduced, arc lamps of 1200 nominal candle-power being cut from $110 to $105 per lamp per year for all-night service.

Central Station
Management, Policies and Commercial Methods

MERCHANTS' STREET LIGHTING IN CHEYENNE.

Cheyenne, Wyo., has just witnessed a great advancement in decorative street illumination. One or two merchants secured the co-operation of the electric company in lighting ornamental column lights in front of their stores, and within a few months, following an active campaign by the lighting company, fully 50 per cent of the business district, comprising at present some six blocks, has been lighted in a similar manner. The columns are heavy and substantial and are surmounted by five globes containing 100-watt tungsten lamps. The spacing is about uniform, but laid out more in reference to the buildings than to equal spacing. The effect is excellent and the increase in business on these streets is very observable.

CENTRAL-STATION RESULTS AT CAMBRIDGE, MASS.

The annual report of the Cambridge (Mass.) Electric Light Company has been filed with the State for the year ending June 30, 1910, and the records of the year show an increase in total revenue and a slight reduction in the net cost of manufacture at the generating station. The company's total revenue for the year was $335,111, compared with $310,209 in the preceding twelve months. The 1910 income consists of commercial arc and incandescent lighting, $169,918; street lighting, $68,071; electric motor service, $87,602, and energy sold to other companies, $9,520. There was a gain of about $9,200 in commercial incandescent lighting, and an increase in sales for motor service of about $15,100, or practically 21 per cent.

The total expenses of the company for 1910 were $174,783, the principal items being: Manufacture, $69,141; distribution, $44,911; office expenses and management, $17,885; taxes, $33,089. The total expenses increased about $13,500 over those of 1909. The net cost of manufacture at the switchboard of the generating plant was 0.94 cent per kw-hour, compared with 1.02 cent in the preceding year. The company burned 9642 tons of New River coal during the year at an average cost of $3.57. The 1909 coal cost was $3.72 per ton.

The company delivered 7,344,392 kw-hours at the switchboard during the year and sold 4,854,664 kw-hours. In its own lighting and auxiliary service the company consumed 422,334 kw-hours. The sale of energy for motors totaled 3,027,476 kw-hours, compared with 2,514,122 units for motor uses in 1909, and the sales to metered customers for lighting aggregated 1,590,801 kw-hours. Street lighting consumed 1,289,422 kw-hours. Energy is supplied by the company to the municipal lighting system of Belmont, Mass., the delivery and measurement being at the town line. For this service the company supplied 236,387 kw-hours at a price of 4 cents per kw-hour.

The total connected load of the company on June 30 was about 8839 kw, consisting of municipal arcs, 297 kw; commercial arcs, 26 kw; municipal incandescents, 31 kw; carbon lamps, 4414 kw; tungsten lamps, 40-watt units, 225 kw; Nernst lamps, 109 kw, making the total connected lighting load 5103 kw; motors, commercial, 3215 kw, and municipal, 22 kw. The company reports 1811 customers using incandescent lamps only, 89 using electric motors only, and 150 using both lamps and motors. The total number of customers is 2056.

The total cost of the plant on June 30 was $1,082,460, the larger items being: Steam plant, $295,008; underground lines, $221,292; land $212,240; overhead lines, $140,489; electric plant, $114,555; transformers, $44,384; meters, $39,412. The total valuation of the plant by the assessor in May, 1910, was $1,125,000, so that there was an excess of tax value over the cost or book value of $42,540. The company had 259 transformers in use last June, and 3161 meters. Additions made to the plant during the year cost $32,858, the largest item being meters, $10,168. The outstanding capitalization of the company on June 30, 1910, consisted of 8000 shares of stock of the par value of $800,000. The total dividends declared in the year amounted to $160,000.

COOKING A DINNER FOR EIGHTEEN ON AN ELECTRIC RANGE.

Electric cooking utensils are in widespread use for preparing breakfasts, luncheons or parts of meals, but the preparation of an entire dinner for a large party on an electric range is not so frequent. Therefore a dinner of this sort which was cooked and served to eighteen persons at the Electric Shop in Chicago on the evening of Sept. 15 was an event of especial interest.

The dinner was given partly as a working demonstration of the electric range No. 30, made by the Hughes Electric Heating Company of Chicago. The Electric Shop, as is generally known, is the handsomely appointed display room and retail sales department of the Commonwealth Edison Company. Mr. J. J. Schayer, its manager, with his sales force; Mr. T. M. Caven, of the Hughes Company, and a guest or two composed the party that sat down to the dinner, which was a good one.

As mentioned, there were eighteen present, and a full dinner was served, consisting of consommé, roast beef, mashed potatoes, lima beans, a salad, peach shortcake, and coffee. The meal was cooked in two hours' time, with a consumption of electrical energy of 2310 watt-hours, or 128 watt-hours per person. Figuring this on a basis of 10 cents a kw-hour, the cost for the electricity for cooking the food for each person was 1.28 cents. Divided among the different elements of the dinner, the consumption of energy was as follows:

Consommé	176 watt-hours
Roast beef	1318 " "
Lima beans	196 " "
Potatoes	219 " "
Shortcake	146 " "
Coffee	255 " "
Total	2310 watt-hours

The consommé, of which there were two quarts, was made on the 880-watt burner, which was run at full heat for five minutes, after which the energy was turned off and the storage heat in the burner finished the cooking. The roast, which weighed about 16 lb., was cooked in the oven, which has a total capacity of 1760 watts. The heat in the oven was turned on for ten minutes before the roast was put in; after the meat had been in the oven ten minutes, the electricity was turned down to the next low heat, or medium heat, which consumes 440 watts. This was left on for an hour and forty minutes, at the end of which time the roast was taken out.

Immediately upon removing the meat, the pastry for the shortcake was put in the oven, being subjected to the high heat for five minutes, after which the electricity was turned off and the cake left in for three minutes longer, when it was baked perfectly. The potatoes, of which there were half a peck, were put on the 880-watt burner and boiled for fifteen minutes at full heat, after which the electricity was turned down to 220 watts and this heat was applied for thirty minutes, giving a consumption of 219 watt-hours. The coffee was made in individual percolators taking 500 watts each, and these were operated for ten minutes, the total consumption of electricity being 255 watt-hours.

The range used is designed for the ordinary requirements of

a family not to exceed eight people, but the Electric Shop dinner shows what can be done with it when it is necessary to use it in serving a large dinner. To use the electric range economically, it is necessary to manipulate the heating with intelligence and good judgment, something after the manner indicated in the foregoing description of how this particular dinner was cooked. The cooking in this case was done by a lady who is not a professional demonstrator, but who prides herself on her ability to operate her kitchen at the minimum cost.

EXPERIENCE WITH SEWING-MACHINE MOTORS IN CHICAGO.

Estimates of the number of electric sewing-machine motors of the household type in service in Chicago and its immediate suburbs vary, but it is thought that from 800 to 1000 of these motors are in service. The central-station companies encourage the use of these attachments, although their consumption of electrical energy is individually slight. It is found that the use of one electrical device in the household serves as a precedent for the introduction of others. Thus, an electrically operated sewing-machine will help in the introduction of a motor-driven washing-machine, and vice versa. The introduction of sewing-machine motors is, therefore, considered of wider importance than merely in relation to the additional load secured, although, as every little helps in the matter of day load, this is not despised.

The Commonwealth Edison Company is alert to push the sewing-machine motor at all times. This labor-saving device is advertised and various leads are followed up by the salesmen. The North Shore Electric Company likewise finds it worth while to pay considerable attention to this device. Both companies have the motors permanently displayed in their showrooms, and the North Shore Company makes a specialty of selling the motors on instalments, giving the customers a year's time in which to pay for them. When a sewing-machine motor is sold by the central-station companies they send out a man to install it and connect it and see that everything is in running order. The installation of these small motors is a comparatively simple matter, but the electric-service companies, nevertheless, take the precaution of seeing that the work is done by a competent man. Sewing-machine motors are also sold by dealers in electrical supplies, and the manufacturers of the apparatus are also naturally interested in pushing the sales. An arrangement is often made to rent the motor at a small sum to be paid weekly, this rent to apply on the price of the machine.

The arguments used in urging the introduction of these motors for domestic purposes are that they relieve women of part of the drudgery of household life and are distinctly conducive to health, while the cost of operation is very small. It is said that many women who are strong enough to do the washing for a household are forbidden by their doctors to operate sewing-machines by the ordinary treadle method. Of course, where there is a great deal of sewing done at home the motor drive of the sewing-machine becomes a more important factor. Nevertheless, there are many ladies who are in no sense required to do so who like to do the finer classes of sewing themselves on their own machines at home, and to this class, too, an appeal is made.

Manufacturers of various articles of wearing apparel who give work out to be done at home are often interested in the introduction of sewing-machine motors among their workpeople, for the reason that they find that by the use of the electric motor attachment a woman can do at least twice as much work at home as by foot-power. A manufacturer of this class in Chicago has a sewing-machine equipped with electric motor on exhibition in the room of his factory where the women come in when they apply for work to be taken out and executed in their homes. This manufacturer neglects no favorable opportunity to tell the women taking out the work that the motors will make their task easier and also increase their income greatly, for this class of work is paid for by the piece. Dressmakers also constitute a class who are urged to use the electric motor drive for their sewing-machines.

There are many different styles of sewing-machines designed for household use, perhaps 150 of them. There are also several types of electric motors designed to drive sewing-machines. The motors are adapted to be started, stopped and regulated in speed by the motion of the foot treadle, leaving the hands of the operator free to guide the work. Very excellent speed regulation is obtained, ranging from the slowest stitching—that is, with a pause after every stitch—to the highest practicable speed desired for long, straight seams. Motors are provided for both direct-current and alternating-current circuits, and for all commercial voltages and frequencies.

As there are so many different kinds of household sewing machines, some variation is necessary in the matter of connecting the motor to the machine. However, electric motors are now available to fit any type of household machine, including the drophead design. Of course, there is a large demand for motors to drive sewing-machines in factories, but this is a different class of work.

Almost always the customers are satisfied with their experience with electrically driven sewing-machines. If troubles arise, they are usually sewing-machine troubles and not electric-motor troubles, although the electric motor is sometimes blamed unjustly when there is some fault in the sewing-machine itself.

An electric sewing-machine motor forms an acceptable present for a lady who does her own sewing. Husbands often buy them to give them to their wives as a little surprise, and it is found that the sale of these devices is considerably augmented just before the holiday season. The motors are not only used to drive the machine itself, but are supplied with bobbin-winding attachments, so that by a simple adjustment the various types of bobbins may be wound by the power of the motor.

LIABILITY FOR INJURY FROM ELECTRIC SHOCK.

The question has been presented to a court of last resort, probably for the first time in this country, as to whether a power company can be held liable to a person injured by contact with a live wire belonging to a street-lighting company, at a point beyond where the current has been delivered by the power company to the street-lighting company. The question came up in the case of Fickeisen vs. Wheeling Electrical Company, 67 S. E. Rep. 788, and it was decided by the Supreme Court of Appeals of West Virginia in favor of the power company. The facts involved were these: A person walking along a public street in the city of Bridgeport, Ohio, came in contact with a wire used in connection with the street-lighting system, which had fallen from the cross-arm of an electric light pole, the contact resulting in his death. His administrator brought suit against the Wheeling Electrical Company, which company was located in Wheeling, West Va., and manufactured the electricity which caused the death. The wire which carried the current belonged to the Bridgeport Electrical Company, which was engaged in supplying electric light for the streets and houses of Bridgeport, Ohio. The Bridgeport Company purchased the electricity which it used from the Wheeling Company and the current was delivered on the Ohio side of the Ohio River, where the wires of the two companies connected.

The lower court held that the Wheeling Company was liable on the theory that, the current being continuous from the wires of the Wheeling Company to the wires of the Bridgeport Company, there was no specific point of delivery where one might say that the right to the electricity of one company ended and that of the other began. This was reversed by the Appellate Court on the ground that electricity is personal property and capable of sale as other commodities of trade. Under the law of sales, when the Wheeling Company delivered the electric current to the wires of the Bridgeport Company on the Ohio side of the river, the title and possession of the Wheeling Com-

pany ceased, and the Bridgeport Company took title and possession and was thereafter responsible for negligence in connection with its use.

"Suppose," said the court, "that at the end of the bridge the Bridgeport Company had a storage battery for the storage of electricity, and that the Wheeling Company had delivered the electricity into the storage battery, and the Bridgeport Company had taken it therefrom for lighting the streets, and that someone should be killed from the grounding of a defective wire of the Bridgeport Company? Would you say that the Wheeling Company in that case would be liable? We think not. Though this mysterious agent, friendly, yet sometimes deadly to man, be unseen and unseeable, still it had substance so far as to be measured. A certain quantity measured by volts performs, under the law of some of the States, the deadly function of electrocution of the murderer. It is capable of measurement by the volt. In this case it was delivered in quantity known by one company to the other. When it reached the point where the unfortunate Whitney met his death whose property was the electricity? So far as the human mind can realize, it was the property of the Bridgeport Company. It was there as an active, deadly agent, producing the death of Whitney, and that agent was the property and in the possession of the Bridgeport Company, because it was on its wires. So far as we can use the word 'possession' as applied to electricity (and we can so use the word), it was in the possession of that company."

It was further said by the court: "The strongest view that can be presented to the contrary is that the Wheeling Company had sold this dangerous agent, knowing that it was to be conveyed over wires, and that unless such wires should be good and safe this agent might work harm, and that it must inspect such wires; that it was using those wires in performing its contract with the Bridgeport Company; and that it must see to the safeness of the instrument of delivery. But the fault of this argument is that it disregards the fact that delivery of the electricity has been already made, at the bridge end. It did not use the wires of the Bridgeport Company. The wires of the Bridgeport Company were not the vehicle of the conveyance of electricity as still the property of the Wheeling Company. As well might we say that when the seller of an article conveys it in his wagon to the place of delivery, and there transfers it to the wagon of the purchaser, and when harm is done by the latter's wagon or by the article later on, the seller would still be liable for damages therefrom. Surely a seller of an article, dangerous or not, after delivery to the purchaser, is not liable to a third party for damages therefrom. If a manufacturer of electricity sell it to an owner of an automobile to be used in running it, the seller would not be liable to a third person damaged by the badness of the storing receptacle or the automobile. There is no privity of contract between them, of course, and liability cannot be predicated on contract in such case."

The court admitted its inability to find any direct authority exactly fitting the case and referred to the question as an "important case of first impression in this State." Many decisions bearing somewhat upon the question, and in both ways, were cited. Amid the conflict of authority the court followed those which it felt were more sound. A Tennessee case was cited in which a horse was killed by a defective electric wire, while hitched in front of a house; the wire being owned by the owner of the house and used in connection with an electric sign in front of it, and the electrical company having no interest in or control over it. It was here decided that the company could not be held liable, the court saying: "We understand that liability for an injury depends upon the interest in or control over the appliance, and if there is neither interest nor control, there would be no liability." So, where a depot which was wired by the company owning it was destroyed by fire and the insurance companies which paid the loss brought suit against the electric light company which supplied the current for lighting purposes, it was held that judgment should be in favor of the electric company on the ground that it had nothing to do with wiring the building. And where a guest at a hotel was injured by an electric light falling upon him, which burned his back, it was held that, as it was not shown that the wiring was done by the electric light company, it could not be held responsible for the injury. In another case it was held that a person who was injured while turning off the electricity on his premises could not recover of the company supplying the current for the reason that he himself owned the electrical apparatus in his house. Upon these principles it was held in the present case that the Wheeling Company was not liable.

Wiring and Illumination

DECORATIVE LIGHTING IN MEXICO CITY.

The electrical illumination of Mexico City during September was one of the most attractive features of the celebration of the centennial anniversary of Mexico's independence. The Mexico Light & Power Company reports that approximately 300,000 additional lamps were in use upon the streets and to decorate the exteriors of the different public and business buildings and private residences. The grounds of Chapultepec Castle, the summer home of President Diaz, were a blaze of light. The National Palace, where the offices of the President and his cabinet are situated, was decorated with 30,000 incandescent lamps. In addition to these 100 arc lamps shed their bright rays from different parts of the exterior of the ancient building. The historic cathedral edifice, situated diagonally opposite the National Palace, was a beautiful picture by night with its thousands of incandescent lights that mark the outlines of its towers and the various openings. Many of the decorative designs upon the private buildings were unique and beautiful.

DIRECT COMPARISON, ACUITY AND FLICKER PHOTOMETRIC METHODS COMPARED.

By Sydney W. Ashe.

In previous articles[1] the author has referred to some investigations carried on employing photometric measurements. The flicker photometer used in making these measurements was described in the *Electrical World* by the writer's associate.[2] The articles referred to have been commented upon in an interesting way by Mr. J. S. Dow,[3] who has carried on instructive experiments along lines somewhat similar to those suggested by the writer. It is the purpose of the present article, without going into specific details, to comment upon some of the results obtained. An attempt was made to compare two 16-cp carbon lamps on the some photometer with the direct-comparison method, the acuity method and the flicker method to see whether the mediums of each set of readings would coincide. With the lines of the flicker photometer not rotating and set so that both sides of the comparison wedge were visible, a series of readings was taken by the direct-comparison method. Starting the lens rotating another series of readings was taken using the flicker method. The wedge was then removed and type was inserted on both sides of the wedge and a series of acuity values was obtained.

In order to obtain the most accurate value the median of each set of readings was taken. Ten settings were punched in the strip of paper on the photometer bar, and counting from either right or left an arrow was marked between the fifth and sixth readings. This value was then read off from the

[1] "The Bearing of Modern Illumination Upon Physiological Optics," *Elec. World*, Feb. 25, 1909. "The Flicker Photometer," Nov. 25, 1909.

[2] David Edgar Rice, *Elec. World*, Feb. 24, 1910, "Heterochromatic Photometry."

[3] J. S. Dow, *Elec. World*, Feb. 24, 1910, "The Flicker Photometer."

scale of the photometer bar. A few interesting things were noted in making these measurements.

1. Although every precaution was taken to eliminate all possible errors, physical and physiological, the medians of the three sets of values did not coincide.

2. Between the direct-comparison method and the flicker method there was always a definite difference of from 1 per cent to 3 per cent.

3. The readings by the flicker method clustered most closely about the median, those of the direct-comparison method were about twice as scattered and those of the acuity method were about five times as scattered.

4. When the flicker photometer alone was used it was much easier to compare lights differing in color than those of the same color, the flicker being more decided where the difference of color was marked. This fact did not harmonize with numerous other statements previously printed to support the belief that the flicker is solely a function of brightness.

5. Where so-called green and blue incandescent lamps were used the values for the flicker photometer clustered even more closely together, those of the direct-comparison method diverged about twice as much as before and those of the acuity method were about the same.

6. In taking the direct-comparison readings if the observer occasionally removed his eye while making settings the values clustered more closely together. This fact was marked particularly with the colored lights.

7. The medians of different sets of values where colored lights were used with the direct-comparison method seemed to disagree slightly, the observer's concept of the intensity value of different colors seeming to change.

ANIMATED ELECTRIC ADVERTISING SIGN.

By S. D. Levings.

The present perfection of the animated electric sign may logically be said to be based on a step-by-step action, the steps consisting of the energization of stationary electric lamps in such a manner and with such changes of location as to produce the effect of motion. But the imagination must needs be brought into play before the result is fully accomplished. This step-by-step idea, fully evolved, is the fundamental basis of the motion picture as observed from its projection on the screen. It was found by experiment that twelve projections per second could be cast upon the screen, at which rate of speed the eye could not distinguish between the individual projections, hence positions of the objects. It was also found that at about ten projections per second the eye could differentiate between them.

Many electrical engineers have been from time to time engaged in a solution of the sign problem, which would have as a result the effect produced by the motion picture as cast upon the screen. In such a solution many obstacles present themselves. In the first place, a flasher to produce a rapidity of change as great as twelve per second would be impracticable of maintenance if not of design. Secondly, and far more important, the time factor of illumination of the incandescent lamps used enters. The time required for an ordinary carbon-filament lamp to reach maximum brilliancy and return to darkness again is such that a rapidity of twelve illuminations is not possible. In other words, one line of lamps could not reach maximum brilliancy and be extinguished again in time for a series of lines to be illuminated at the rate of twelve per second. These points and many others effectually condemn the step-by-step system of conveying to the observer the effect of continuous motion. The solution proposed by Mr. E. J. Prindle, of New York City, is to move the lamps themselves, and on such a basis Mr. Prindle has designed an animated electric sign.

The first sign of this type was exhibited in a hall in Newark, N. J., and occupied a space approximately 20 ft. x 80 ft. First the outline of a man's head appears. The face has a distinct expression of surliness, and to add to the ugly mood represented the figure's eyes are cast down. The corners of the mouth droop. Fig. 1 shows the initial illumination. A sign in true perspective, bearing the legend "Uneeda Biscuit," then appears in such a position as to be in front and distant from the figure. After the sign appears, the figure raises its eyes, still maintaining, however, its expression of bad humor. Fig. 2 shows the expression of the figure at this juncture. No change in the illumination occurred whatever. After gazing at the sign for a moment the figure's hand, clasping a biscuit, comes into relief, held in the position shown by Fig. 3. Immediately the hand is outlined the eyes again drop. The hand is next raised, the mouth opens and the biscuit is inserted. The jaws then close upon the biscuit, and the hand following this movement recedes from the mouth carrying the remainder of the biscuit.

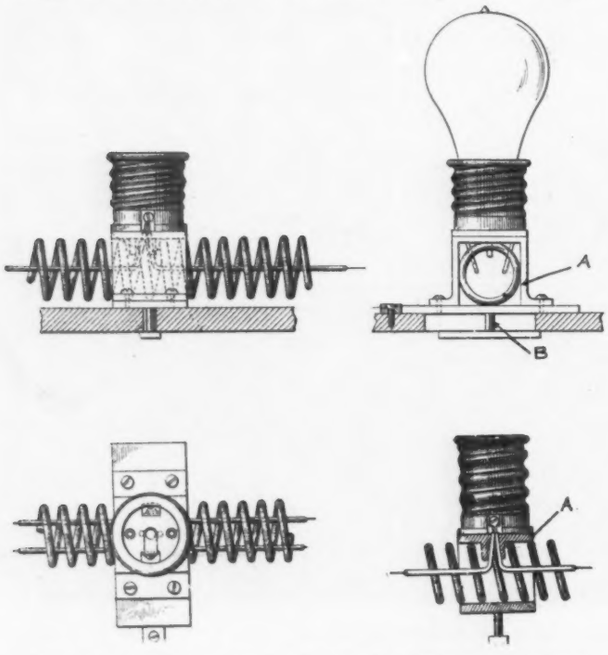
Figs. 1 to 6—Changing Facial Expressions in Animated Electric Sign.

The biscuit is shortened by the bite taken from it. Fig. 4 shows the figure at this point; the drooping corners have disappeared, thus changing the whole expression of the face.

Fig. 5 shows the shortened biscuit and the jaws closed upon the bite. The figure then proceeds to masticate the bite, and Fig. 6 shows the final expression. A few lamps were lighted or extinguished during the expression changes, as may be noted by the droop line in comparing Figs. 1 and 6, and also by the two small creases, one below the eye (see Fig. 13) and one to the left of the mouth. Other facial expressions, however, were obtained by actual movement of the lamps, and an instance may be cited of the position of the eyebrow lines in comparing Figs. 1 and 6.

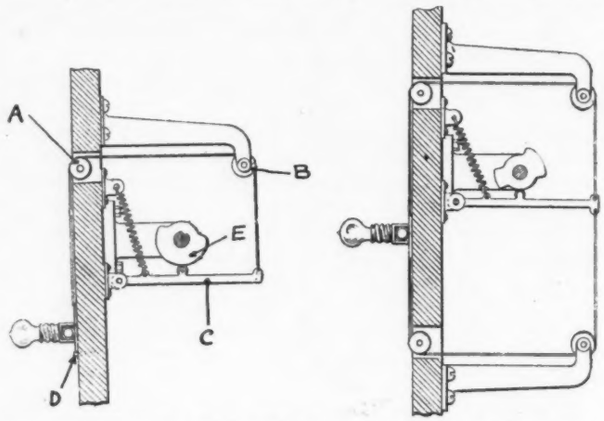
The body of the sign is similar to the present type, and is capable of the same mounting and flexibility of design. The apparatus for producing the movement of the lamps is applied to the rear of the board at the various points necessary, such parts being provided with a housing for protection from the weather. There are two principal divisions of the electrical effects; first, that of stationary lamps such as form the outline of the head and shoulders, the bridge of the nose, etc., and, second, that of movable lamps such as form the eyebrows, jaw, wrinkle lines, etc. The stationary lamps may be of any type, and may be mounted on the face of the board, or recessed in it, according to the effect desired and the angle from which the sign may be viewed. The movable lamps are mounted on a coiled spring, as shown in Fig. 7. A special lamp socket adapted from the standard incandescent socket is mounted on a bridge piece, as shown at *A*, Fig. 8, which in turn is mounted on a plate secured to the face of the board. This plate is held to another plate at the rear of the board by the pin shown at *B*, which passes through a slot provided in the board. This slot is designed in length to conform to the maximum locations necessary for the lamp or lamps during the complete cycle of the sign's action. Owing to this construction, the springs holding the lamps may be shifted laterally over the limits of the slot to form any desired shape, and may be stopped at any position desired, to be again shifted at the proper time.

Connections to the lamp are made from a circuit which passes through the coiled spring. This arrangement is shown in Fig. 9.



Figs. 7, 8, 9 and 10—Details of Movable Lamps and Sockets.

In order to prevent the lamp sockets shifting positions on the springs the saddle construction shown at *A* in Fig. 10 is applied to them. This plate fits over the wire of the spring and holds the lamp socket in position. The lamps may be required to move, all at the same time, direction and distance, in any given portion of the sign, or they may be required to advance or recede independently of their neighbors on the same spring. There are two ways in which this movement has been provided for; one, by a cord attached to the lamp socket or point of contact with the spring, which passes through the board over a pulley as shown in Fig. 11 at *A*, and thence over another pulley attached to a bracket as shown at *B*, and thence down to a



Figs. 11 and 12—Section Views of Apparatus for Moving Lamps.

permanent fastening on the movable lever shown at *C*, Fig. 11. In this case a stop shown at *D* is placed on the face of the board against which the spring rests when in normal position. The movement of the spring is accomplished in the following manner:

A shaft is mounted vertically or horizontally on the rear of

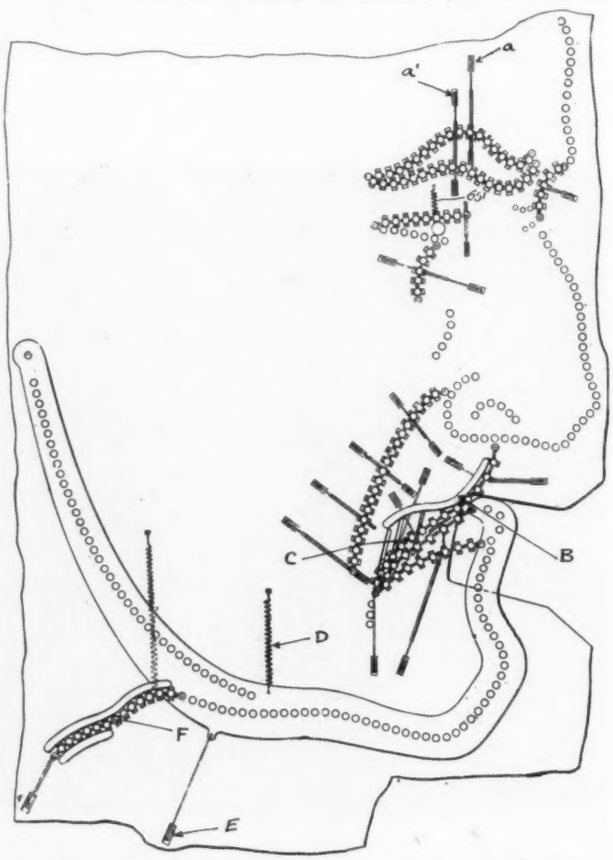


Fig. 13—Diagram Showing Arrangement of Lamps Outlining Face.

the board according to the direction of the desired motion, and upon this shaft are mounted cams so situated as to engage the movable lever shown at *C*. A roller is provided on this movable lever to reduce friction and wear. The depressions in the cam shown at *E* are so designed that the movable lever will be

depressed the proper distance to pull the spring to the required height by means of the connecting cords. The action is apparent. It has been found since working out this portion of the sign that hinged or pivoted levers will give superior results

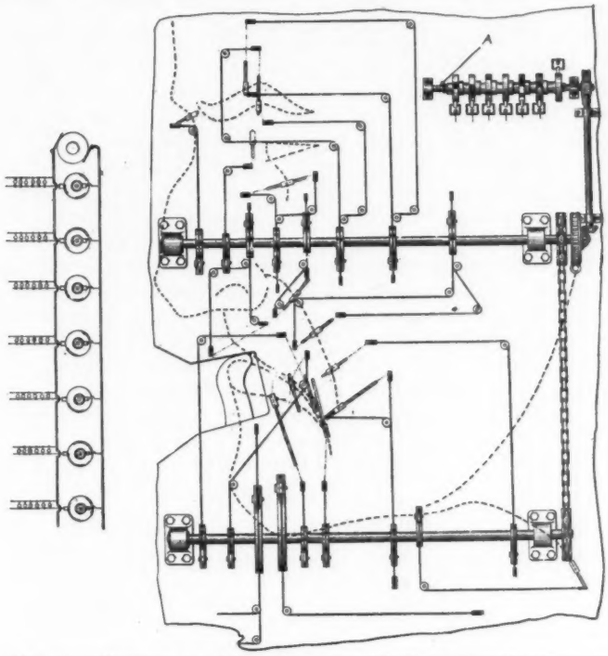


Fig. 14—Diagram of Apparatus for Effecting Combinations of Lamps.

over the cords, and will have a much longer life. Where the stop method as just described will not result in the desired motion, the scheme shown in Fig. 12, based upon the same principles as illustrated in Fig. 11, is used.

A broader application of the moving principles may be seen in Fig. 13, which is a portion of the face shown in Figs. 1 to 6 inclusive. In order to gain the expression of a frown or smile the eyebrows play an important part. At *a* and *a'* in Fig. 13 may be seen the slots provided for the levers that pass through to the back of the board and the cam mechanism. By comparing the eyebrow lines in Figs. 1 and 6 it will be noticed that the divergence is markedly different in the two, and the continuous movement from one position to the other is obtained in the manner just described. Again, the crease starting at the nose to form part of the expression is considerably different in form in Figs. 1 and 6. In Fig. 13 will be seen the varying lengths of levers, or cords, as shown by the drawing, which govern the curve of the springs of lamps forming the crease. The stationary lamps forming the bridge of the nose, forehead and lower portion of the face are indicated in Fig. 13.

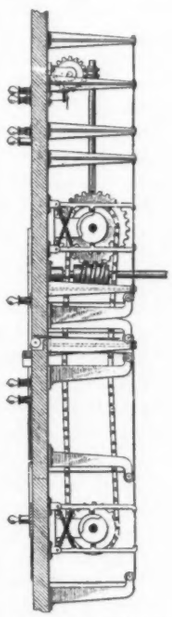


Fig. 15—End View of Apparatus Shown in Fig. 14.

Additional changes in the direction of the springs may be produced by placing stops of the correct dimensions and shape at given locations. For instance, at *B*, Fig. 13, may be seen the curved stop which governs the shape of the upper lip line. The position of the spring *C* is that of the face wearing the expression shown in Fig. 1, while the expression shown in Fig. 6 is produced when the spring *C* is pulled up against the curved stop *B*.

Illustrative of the various forms of movement that may be obtained in this design attention is called to the jaw as seen in Fig. 13. When the figure bites the biscuit and chews upon it the effect is produced by the jaw being hinged at the natural point for such action to appear. A spring shown at *D* is provided to hold the jaw in place, while the actuating lever works in the opening *E*. The "Adam's apple" line *F* is actuated shortly after the biscuit has been bitten and chewed, and gives the appearance of swallowing.

In obtaining different combinations of action it is necessary to provide for the addition and subtraction of lamps as the movement progresses. This action is taken care of as shown by Fig. 14. This is a view of the rear portion of the board of which Fig. 13 is the front. At the left are shown diagrammatically several circuits, each of which is provided with a commutator. These may all be mounted on a single shaft as shown at *A*, and may be driven by a series of gears from the same shaft and by the same power that drives the movement levers. The practical use of this scheme is best illustrated by the biscuit, which, when bitten, is foreshortened the proper amount. The commutator serving that portion of the sign is so timed that it cuts the energy off at the proper instant, while another commutator throws on another set of lamps which connect the two sides of the biscuit and again form the end of it. Fig. 14 shows the general scheme for the driving gears by which means the movement levers are actuated. The number of shafts is a matter of design, the minimum being used that will serve all portions of the sign to good advantage, electrically and mechanically. Fig. 15 is the end view of Fig. 14.

NEW TELEPHONE PATENTS.

PARTY-LINE SYSTEM.

A party-line system has been patented by Mr. R. C. Livingston, of Spring Valley, Minn. The line is broken up into sections, which are controlled by means of switches at the various stations. Any two stations in communication occupy the line between them, but both ends, beyond them, are available for other uses.

EXCHANGE RELAY.

A combined line and cutoff relay comprises the special feature of a telephone system for which a patent has been granted to Mr. O. C. Dennis, of Chicago. This relay is ironclad and the contact springs are carried upon the coil heads. A loose core is provided, each end of which is surmounted by an insulating cap. The relay has two windings, each confined to one end. As the core slips back and forth under the influence of the coils it drives the contact springs into proper positions.

CIRCUIT FOR SEMI-AUTOMATIC SYSTEM.

A semi-automatic system is described in a patent granted to Mr. J. L. Wright, of Washington, D. C. This system is of the "auto-manual" type, the operator setting up the desired number on a keyboard. Impulses are forwarded from a continuously moving impulse shaft and wheels. It is, of course, therefore essential that no call be started except at what may be termed the beginning of a rotation of the impulse wheels. The feature of the system under consideration is the circuit and mechanical management for assuring this. The sending circuit is controlled by two locking relays which will operate only in proper sequence. These are both energized at will by the operator, but one undoes the effect of the other. Therefore, nothing is affected at the sending circuit by locking the two relays. The beginning of a rotation of this impulse system is marked by an insulated spot on one of the wheels, which releases one of the relays, and at the completion of a rotation it releases the second or cut-off relay. The latter can in no way be released first, as its release circuit is of no effect unless its companion relay be released first.

REINFORCED RECEIVER SHELL.

To strengthen the standard hard rubber or similar receiver shell to overcome excessive breakage has been found quite a problem. The solution of Mr. E. Schwartz, of Belgium, is described in a recent patent. He forms a thin sheet-metal shell,

over which he lays a coating of the insulating compound. This latter is of similar composition and thickness to the usual shell. A further improvement lies in the use of a heavy metal rim at the cap end of the shell, which ring carries the threads. The corresponding cap threads are upon the metal cap lining.

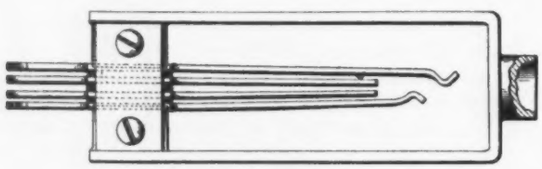
NEW APPARATUS

Of all devices required in the operation of a telephone plant, the receiver has probably been subject to the least change. Universally, the receiver has been an electromagnetic device. However, it has long been recognized that other principles of operation can be resorted to as exemplified by the condenser telephone, where the operation is due to the mutual attractions of the two oppositely charged plates of a condenser. Moreover, it has been found that the microphone is, in a rather weak way, reversible, being capable of originating very weak sounds in response to received currents. More recently, the speaking arc was devised.

Different from all of these is the receiver recently patented by Messrs. N. J. Wohl, of New York City, and Harry Hertzberg, of Brooklyn. This receiver is based upon the expansion due to thermal effects of the received currents. A leakage is arranged, one end being anchored and one end attached to the diaphragm at its center. One or more members of the linkage are fine conducting wires through which the telephone currents are led, and the expansions and contractions of these cause a corresponding pull upon the diaphragm.

Mr. G. S. McComb, of San Francisco, has invented and patented a wire receiver support of great simplicity. The wire is specially formed. One end clamps beneath the nut of the transmitter-adjusting clamp at the right of the transmitter. The wire then leads forward, thence to the left over the mouthpiece, which acts as a support. It then again turns forward, where it is formed up into shape for retaining the receiver.

A spring-jack construction forms the subject of the patent granted to Mr. H. J. Kusel, of Chicago, and assigned to the Century Telephone Construction Company. Use is made of a U-shaped frame, the jack springs being mounted within the U.



Kusel Spring Jack.

The jack sleeve or plug guide springs from the middle of the bottom of the U, while a cross-bar near its outer end carries the springs. The accompanying illustration shows the general arrangement.

TELEPHONE AND CONTROL SYSTEM.

Under this head falls a system patented by Mr. H. G. Webster, of Chicago, and assigned to the Kellogg Switchboard & Supply Company, which superimposes upon the telephone system a time-clock system. A triple-wound coil is inserted in each subscriber's line having the clock service. The primary leads are joined to the clock-control circuit, while the two secondaries are respectively connected in the two line limbs. These secondaries are mutually non-inductive, but are inductive to the primary. Bridged at the substation is a relay between condensers. This relay is highly inductive and therefore of little effect in shunting telephone currents. At the clock-setting period the master clock closes a circuit and thereby introduces a low-frequency alternating current upon the triple-coil primaries. The secondaries respond with equal and balanced power. Therefore, the opposing currents generated in the two sides of the line do not affect the telephone apparatus. However, the middle of the bridged relay at the substation is grounded, and both sides of the telephone line are also grounded at all times at the central office. Therefore, a circuit is completed for the alternating clock current, which causes the actuation of the clock-control relay at the substation.

Letters to the Editor.

Esperanto.

To the Editor of Electrical World:

Sir:—Doubtless you have long ago formed your opinion as to the merits of Esperanto, the international language. I hope that it is favorable; but as there is much irresponsible criticism of Esperanto, especially on occasion of the recent international convention in Washington, I want to offer an opportunity for every thinker to judge for himself. I have had prepared 100,000 brief grammars of the language in pamphlet form, and will send one free to any person who is sufficiently interested to ask for it, enclosing stamp for reply. I think it really due to this great movement for an international auxiliary language, which now embraces *fifty nations* in its scope, that you publish this letter so that your readers may have the opportunity of judging for themselves.

Chicago, Arthur Baker,
700 E. Fortieth Street. Editor *Amerika Esperantisto.*

Central Station Rates.

To the Editor of Electrical World:

Sir:—I have read with much interest the article in your Sept. 15 issue by Harry G. D. Nutting on "Central Station Rates." I believe that Mr. Nutting's ideas meet more nearly the ideas and experiences of managers of small plants than anything which has come to my notice in recent publications.

There is, however, one statement which Mr. Nutting makes which it seems to me should be qualified somewhat. He says, "Anything proportioned on the connected load cannot possibly be correct" and that "it is probable that the most satisfactory way of determining the demand at present is by special investigation as to the requirements of individual consumers."

Unless the demand is actually measured by a meter, on just what factors are we to estimate the demand when we make the special investigation referred to? Will not the connected load be the main factor? Of course, the nature of the load and the nature of the purpose for which it is to be used may be admitted as factors, but these factors tend rather to establish the class in which a customer should be placed than his demand.

Just what constitutes "connected load" is somewhat of a problem in itself. As the term is used in rate-making, I believe it generally refers to the normal connected load when the installation has got beyond its experimental stage and settled down to normal running. To determine this connected load requires a special investigation of each installation, and such details as the nature and location of the lamps, the number of outlets in a room, etc., must be considered; but they should be considered with respect to fixed rules and two installations of the same kind and size should be rated alike.

When a customer wants to know why his fixed charge is larger than his neighbor's, we should be in a position to show him without bringing any personal element whatever into play. If you tell him that his neighbor uses more 8-cp lamps than he does, he will perhaps agree to install the same number of eights that his neighbor has; perhaps he may do so and then be dissatisfied, when the matter will again come before the manager.

It is perfectly true that it is an easy matter to change from 16 cp to 8 cp, and it is just as easy to change from 16 cp to 32 cp; and as to borrowing an electric iron, this too is very true, and I am sure that we are all very glad indeed that the time has come when the housewife thinks more of the electric iron than of the old kind, even if she has to borrow one. If a customer wishes to use one or two 32-cp lamps in a place normally laid out and intended for sixteens, he is simply using his installation and that of the company in a more efficient manner than his neighbor who keeps the sixteen or an eight in use; consequently I do not see that it is very far out of the way

if his fixed charge is not increased thereby. In fact, the sum total of all these small changes which may be made from the normal connected load will, in actual operation, make no difference in the peak demand on the station and very little, if any, on any fixed expenses whatever.

It is, in fact, not absolutely certain that a measured maximum demand is entirely correct for the purpose. Does not a station sometimes have to figure on the possible load which a certain installation may put on the peak even though that installation never does put it on as shown by the meter? When all is said and done the writer believes that at the present time the best way to fix the demand charge is to divide the customers into as many distinct classes as possible and then determine the normal connected load by certain fixed rules. A certain percentage of this connected load should then be taken as the basis for the demand charge. The exact percentage must be obtained from observations of the *average* demands of the different classes and would remain practically constant when once determined.

The metallic-filament lamp is an important factor in determining connected load, but if the central station has the proper control of the lamp situation, it is in a position to know whether or not a customer who is rated on a metallic-filament basis is using this type of lamp or not.

In closing I wish to say with Mr. Nutting, "It becomes necessary to distribute these expenses among the various customers in a reasonable and equitable way. Here is the most difficult part of scientific rate-making," and I believe that the question cannot be too fully discussed at the present time.

Tuxedo, N. Y. S. W. BORDEN.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Shunt Commutator Motor.—R. VAN CAUWENBERGHE.—The shunt commutator motor for single-phase or polyphase currents is started as a series or repulsion motor and is operated as a shunt motor only after it has run up to speed. On the basis of practical formulas the author gives the mathematical theory of the machine operated as a generator or a motor. He thinks the only great disadvantage of this machine is its commutator. Its advantages are the absence of an exciter, the simplicity and exactness of compounding, and the simplicity of parallel operation without surging. If the air-gap is made small enough, the excitations can be considerably reduced so that there are only a few more amp-turns on the rotor than on the stator. There is no possibility of such enormous short-circuiting current as occurs with ordinary turbo-generators where they may assume a value of from twenty to thirty times the normal current. The voltage curve is a perfect sine curve at all loads; this is a great advantage for single-phase generators. The rotor core does not need to be highly saturated, which is an advantage for turbo-generators.—*Elek. Zeit.*, Sept. 8.

Magnetizing Current of Induction Motors.—T. HOOCK AND R. E. HELLMUND.—A critical discussion of the different methods, and their difficulties, of calculating the magnetizing current of single-phase or polyphase induction motors. The authors deal successively with the determinations of the amp-turns for the air-gap, the amp-turns for the stator and rotor cores, the amp-turns of the stator and rotor teeth, and the effect of stray fluxes.—*Elek. u. Masch.* (Vienna), Sept. 4.

Lamps and Lighting.

Quartz Tube Lamp.—An illustrated description of two new mercury-vapor quartz-tube lamps of British make fitted in a globe so as to give the appearance of an arc lamp. One is

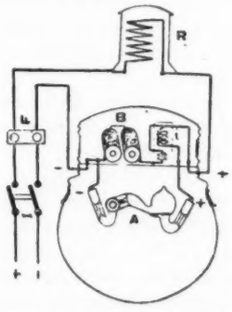


Fig. 1—Diagram of Quartz Tube Lamp.

called the silica lamp and consists of a clear or opal globe, which fits on the totally enclosed metal case, and can be lowered at will, leaving the inside open for inspection, etc. A quartz tube *A* (Fig. 1) of somewhat irregular shape, exhausted to a high degree of vacuum, and containing a quantity of mercury, is the source of light, the luminous portion in the smaller capacity lamps (1200 hefner cp, 4 amp, 100 volts to 130 volts) being about 1.75 in., and in the larger (3000 cp, 3.5 amp, 200 volts to 240 volts) about 4 in. The tube is mounted within the globe on the outside of the base, and is arranged so that it can be tilted and the mercury may be free to run to and from each end. A solenoid *B*, the plunger of which is connected to one end of the quartz tube, and an automatic cut-out *I* are both mounted in the case. An external resistor *R* is mounted in any convenient place. On putting the lamp in circuit by switch 1 the current first passes from the positive main through the resistor *R*, the cut-out *i* and the solenoid *B*, back to the negative main, the solenoid causing the positive end of the tube to be tilted and the mercury to flow along the tube to the opposite end, thereby completing the tube circuit and lighting the lamp. As the cut-out coil is in series with the tube, this now comes into operation and immediately breaks the solenoid current. The quartz tube then falls back to its original position and remains illuminated until the lamp is switched off. As soon as the mercury in the quartz tube meets and the current in the tube is thereby started, a small portion of the mercury is vaporized. This solely constitutes the conducting medium in the tube and is the only source of light, there being a continual process of vaporization and condensation whenever the lamp is burning. The advantages over arc lamps are an absolutely steady light (bluish-white in color) and absence of any deposit within the globe. The comparative running costs per hour, with energy at 2 cents per kw-hour, for the open, enclosed and flame-type arcs, respectively, are given as 5.52 cents, 2.24 cents and 3.64 cents, as against 1.14 cents for the silica lamp, with the same candle-power conditions in each case. Another quartz-tube lamp brought out by another company is called the "quartzlite" lamp and is made to give from 1800 cp to 2500 cp on direct-current circuits. The lamp is made for 100-volt to 150-volt circuits and gives an average of 4 cp per watt.—Lond. *Elec. Review.*, Sept. 8.

Arc Lamps.—O. ARENDT.—An illustrated paper read before the Berlin Electrical Society on arc lamps without regulating mechanism, dealing especially with the development of the Beck lamp. In the original lamp the positive carbon electrode was provided with a lateral rib which rested on a metallic support, and, by gradually burning off, regulated the sliding down of the electrode by gravity. Since 1906 the negative electrode is made to rest on the metallic support and the latter is connected to the supply circuit; silver is used for this metallic support. Ventilation is so provided for the hot vapors that there is no deposit on the globe. Recently a four-arc Beck lamp has been constructed for which, on account of the great heat produced, a special ventilation system had to be designed. According to tests of Goerges a 220-volt, 12.2-amp direct-current lamp has a mean spherical candle-power of 14,300 hefner candles without globe and 8860 candles with globe; oper-

ated with alternating current the mean spherical candle-power is 6340 without globe and 3940 with globe. Goerges calculates therefrom the mean hemispherical candle-power of the direct-current lamp as 25,700 hefners without globe, while some months before this had been determined experimentally as 25,500 cp. "These surprisingly large candle-powers can be explained only by reflection and interference phenomena, since the simple addition of the candle-powers of the four single arcs would not give one-half of the measured and calculated candle-powers." The author finally describes the Thauma lamp, which is a differential shunt-excited enclosed-arc lamp, provided with "Beck regulators," that is, thin iron wire resistors in a glass tube which is evacuated or filled with inert gases. These are in parallel with one-half of the differential shunt excitation.—*Elek. Zeit.*, Sept. 1.

Metallic-Filament Patent.—The British Solicitor-General has affirmed the decision of the Patent Office of July, 1907, to grant a patent to the Consortium f. Elektrochem. Ind. in spite of strenuous opposition. The patent was applied for on July 6, 1906, and covers the process of heating the formed tungsten filament to a temperature close upon its melting point before it is employed in a lamp in order to drive off any impurities and to render it denser. This may be accomplished by external heating or by passing a current through the mounted filament before sealing the bulb. Opposition had come from Drs. A. Just and F. Hanaman and from the German Welsbach Company.—Lond. *Elec. Eng'ing*, Sept. 8.

Metallic-Filament Lamp.—A note on a recent British patent (2432, 1910; Sept. 1, 1910) of the Felten & Guilleaume-Lahmeyerwerke A.-G. In order to ascertain whether the complaints of consumers that lamps have broken down after a short period of burning are justified, a substance that is chemically affected by the light, heat or current is placed in the bulb. The lighting of the lamp will then produce discoloration or some other indication of its proper working. The insertion of checking devices of different degrees of sensitiveness for recording the duration of the passage of current through a lamp is also covered by this patent.—Lond. *Elec. Eng'ing*, Sept. 8.

Lighting and Globe Design.—C. Toone.—An article giving some general considerations concerning the principles of modern lighting. Values are given of the luminous efficiency of various lamps and of their intrinsic brilliancy. Incandescent lamps are frequently, and arc lamps practically always, used in conjunction with a diffusing globe. This globe should be of such a nature and size as to result in a mean intrinsic brilliancy of its surface of from 0.0005 cp to 0.0020 cp per square millimeter, or as nearly within this range as is practicable. Globe diameters of more than 40 cm are not convenient, hence the suggested globe surface brilliancy is frequently exceeded in the case of flame arcs. The diagram of Fig. 2 is useful in globe design. By its aid the required globe diameter for a given surface brilliancy can be estimated, the mean spherical candle-power of the source and the nature of the globe material being known. Conversely, with the same known factors, the probable brilliancy of the globe of a certain diameter can be determined; again, a suitable globe material can be decided on if the remaining conditions are specified. The first suggested application is carried out as follows: The problem is to find the diameter of an opal globe required to give a surface brilliancy of about 0.10 cp per square centimeter with a lamp having a mean spherical candle-power of 975. Through the point, on the left-hand scale of the diagram, representing 975 cp, draw a straight line through the point representing 0.10 cp per square centimeter on the second scale (from the left). Produce this line to cut the center axis in a point A (this center axis is purely constructional). Referring to the table at the head of the diagram it will be seen that the constant $k = 0.50$ for opal globes; hence, through A and the point representing $k = 0.50$ draw a straight line which, produced, cuts the right-hand scale in a point representing $D = 39.5$ cm (15.5 in.); that is, the required globe diameter is about 40 cm. From the following values it appears that from 40 per cent to 50 per cent absorption may be expected with such a globe (large globes absorb a higher percentage than do small globes of the same material): Clear glass, from 5 per cent to 15 per cent; rippled glass, from 20 per cent to 25 per cent; Holophane glass, from 20 per cent to 30 per cent; ground glass, from 30 per cent to 40 per cent; heavily ground glass,

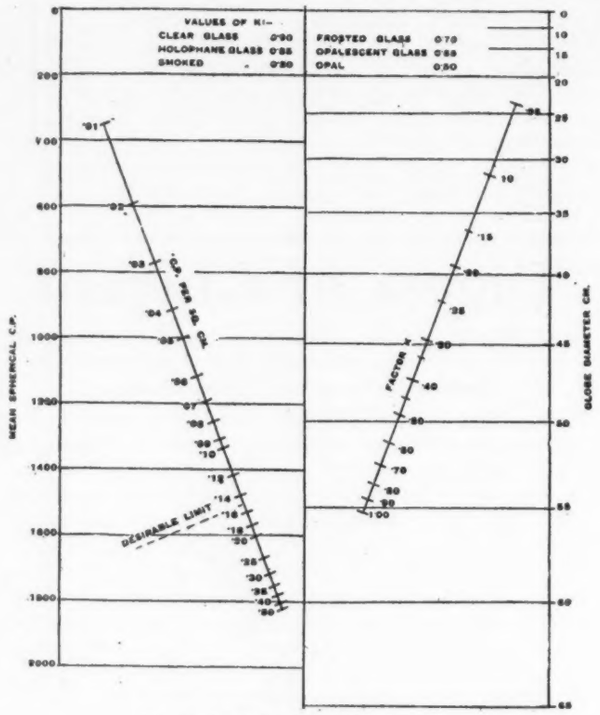


Fig. 2—Lighting and Globe Design.

from 40 per cent to 50 per cent; opal glass, from 50 per cent to 60 per cent. The desirable illumination in most interiors is between 0.7 ft.-candle and 2 ft.-candles. The author considers indirect lighting to be the best for interiors.—Lond. *Elec. Review*, Sept. 9.

Sealing Iron Wire Hermetically into Glass.—H. J. S. Sand.—An abstract of a British Association paper. The glass is fused round the iron wire, and while it is still hot a small piece of heated steel tube surrounding the wire is pushed a few millimeters into the glass. After cooling, the steel tube is soldered to the wire. A vacuum tight seal is produced between the glass and the inner surface of the steel tube, which on cooling becomes slightly stretched and at the same time compresses the glass. The author pointed to the possibilities of this method in connection with electric lamp manufacture and the saving which would be effected by obviating the use of platinum.—Lond. *Elec. Eng'ing*, Sept. 8.

Generation, Transmission and Distribution.

Electric and Steam Hoists.—A preliminary report, signed by Frölich, Dobbelstein and Bütow, on extended tests carried out on eight different hoisting plants under the auspices of the Association of German Engineers and several mining societies in the Dortmund district. The object was especially to get exact comparative figures for electric and steam operation. The four electric plants where tests were made were equipped with the Ilgner system. The power consumed for one hoisting horse-power varied between 1.39 kw and 2.47 kw for the main hoisting period (seven and one-half hours) and between 1.56 kw and 2.70 kw for the whole day (twenty-four hours). In the four steam-operated plants the steam consumption for one hoisting hp-hour varied between 16.5 kg and 26.82 kg (36.3 lb. and 59 lb.) of steam for the main hoisting period and between 24.1 kg and 30.96 kg (53 lb. and 68.1 lb) for the whole day.—*Elek. Zeit.*, Sept. 1.

Electricity for Organ Blowing.—An illustrated description of an organ-blowing equipment in which a motor of small

horse-power running at a slow speed on a direct-current system operates by means of worm gear enclosed in an oil bath a second motion shaft which transmits power by means of cranks suitably joined to the reciprocating motion of the feed bellows. Control is effected by means of a flexible rope worked from the main reservoir, which passes round a drum attached to a specially designed type of controller. The contact-making arm of this controller is free from the shaft and normally hangs in a vertical position by reason of its own weight. When the current is switched on a definite quantity of resistance is in series with the armature, giving a safe starting position for the rheostat. As the reservoir cover rises the radial arm keyed to the shaft and carrying a pivoted armature comes into contact with a solenoid magnet fixed on the contact-making arm of the controller. After this contact is made the two controller arms remain magnetically locked together until the current is interrupted, and the controller thus works as an ordinary series controller. The inconvenient starting switch is thus entirely done away with, an ordinary switch at the console being sufficient to start and stop the motor. The regulating resistance, which is placed in series with the motor, is of special arrangement.—Lond. *Elec. Review,* Sept. 9.

High-Tension Transmission Line in Italy.—A note stating that part of the water-power of the Pescara River, developed by an Italian electrochemical company, is soon to be utilized for supplying electricity to Naples. About 27,000 hp will be transmitted. The transmission line will have a length of at least 200 km (120 miles). The transmission e.m.f. will be 88,000 volts.—*La Revue Elec.,* Aug. 15.

Electric Driving of Rolling Mills.—G. SAUVEAU.—A long illustrated description of the different systems of electric driving of rolling mills, with reference to typical European installations. In the first instalment non-reversing rolling mills are dealt with; in the second instalment reversing rolling mills are discussed.—*La Revue Elec.,* Aug. 15, 30.

Pumps and Compressors.—L. WEIL.—A description, illustrated by numerous diagrams, of the various types of automatic starting and regulating devices for motors driving pumps and compressors.—*Elek. u. Masch.* (Vienna), Aug. 21 and 28.

Traction.

Single-Phase Traction in London.—P. DAWSON.—A paper read before the British Association on the electrification of the London, Brighton & South Coast Railway between Victoria and London Bridge, where the single-phase system is used. He said that experience has shown that the acceleration obtained is quite as good as anything obtained by continuous-current working in spite of claims put forward to the effect that the continuous-current motor would give superior results in this respect. Moreover, the extra weight involved by the transformers, etc., is only 10 per cent. Coming to the question of energy consumption, this was found to be from 70 watt-hours to 80 watt-hours per ton-mile for the single-phase system and from 90 to 100 for continuous current. These figures referred to energy consumption at the generating station; on the trains themselves the figures are practically identical for the two systems. The difference at the station is due to the different transmission efficiencies. The power-factor for the whole system is about 80 per cent. Up to the present the motors have been a complete success. The commutators present a black, shiny appearance, very similar to that of a continuous-current machine; and although the sparking is more obvious than with direct-current machines, yet it does not appear to do as much harm. This result was demonstrated by the fact that the commutators were used for 50,000 miles before it was necessary to turn them down. From the commencement not the slightest trouble has been experienced with the overhead work, and after eight months no appreciable wear of the conductor can be detected. Each bow strip required renewal after running for 15,000 miles. One of the most serious problems was the lowering of the bow from 21 ft. in the yards to 13 ft. under bridges. This was a very difficult matter, but it has been overcome successfully, although in some instances the bow is only 1.5 in. from the under surface of the bridge. Owing to the fact that porcelain is a strong, reliable substance under compression, but weak and unreliable under tension or flexion, the compression method has been adopted throughout. He believes that the system described is the only one where the catenary suspensions are doubly insulated. A feature of interest is the oft-recurring St. Andrew's cross painted on the ironwork at intervals along the permanent way. These crosses mark positions where it is most economical for the motormen to switch off the current, and their adoption has resulted in a saving of from 5 per cent to 10 per cent in the cost of energy. From diagrams it appears that the acceleration obtained is equal to over 1 mile per hour per second. He gave a brief description of an interesting gasoline-electric inspection vehicle for use on the line. This little coach is equipped with a gasoline engine and a small generator, and can be run to any part of the system with great rapidity. It is entirely independent of the overhead wires, and can, therefore, be employed when the current is switched off. The generator provides illumination and enables inspections and work to be carried out with great ease.—Lond. *Electrician,* Sept. 9.

Single-Phase Traction in Sweden.—Some supplementary notes on the trials which have been made on the Swedish State railways with single-phase traction. Data are given on the power-house construction and the automatic voltage-regulation method employed. Use is made of a voltage regulator of Oefoerholm, which is based on the principle of the Tirrill regulator, but differs from it in details. Line construction and the different types of porcelain insulators used are then dealt with, and the test values are given for the impedance and insulation resistance of the rails when used as carriers of the return current.—*Elek. Zeit.,* Sept. 8.

Accelerometer.—H. E. WIMPERIS.—An abstract of a British Association paper on an accelerometer for the measurement of road resistance. The instrument consists of a brass box about 4 in. across, containing a copper disk mounted on a vertical pivot and "damped" in its motions by a permanent magnet. The center of gravity of the disk is purposely removed from the axis so that when the box moves forward one side of the disk tends to lag behind, thus partially winding up a coiled spring and actuating a pointer which moves over a scale. To render the reading unaffected by any accelerations at right angles to the direction of motion use is made of a second parallel axis which is geared to the first one and has attached to it masses having the same mass movement as the disk itself. Couples about these two axes add up in the direction of motion, but neutralize one another in any direction at right angles. The accelerometer, therefore, reads in one of the three directions of space only, and is not affected by even violent movements in the other two directions. With this instrument the author has measured the road resistance of various classes of road and has obtained figures varying from 50 lb. to 210 lb. per ton. On main-line railways the resistance is usually from 12 lb. to 30 lb. per ton, depending on the speed. He has also measured the acceleration of practically all the London electric railways with this instrument. The acceleration of the London, Brighton & South Coast single-phase line was 1.9 ft. per second per second, which was identical with the figure given by Dawson. The breaking retardation was found to be 5.8 ft. per second per second, which was about twice that of the Great Northern, Piccadilly & Brompton Railway, which had about the same acceleration. The main use to which the instrument has been put hitherto, however, is in connection with motor-cars.—Lond. *Elec. Eng'ing,* Sept. 8.

Installations, Systems and Appliances.

The Price of Electricity.—E. W. COWAN.—The first part of a paper read before the Economic Science Section of the British Association. The author criticises the principles on which the charges for electrical energy are usually based, this basis being an equal rate of profit from every class of consumer. Although this principle is safe, the author argues that best economic results cannot be obtained because the factor of demand is entirely ignored. The demand for electricity is of

a "composite" kind, energy being required for lamps, motors and heaters. Classified tariffs should be adopted so as to secure the greatest economic advantage. The author supports his views by reference to the adjustment of prices in railway freight charges and other lines of business.—Lond. *Electrician*, Sept. 9.

British Central Station.—An account of last year's financial record of the Glasgow municipal central station. Of the total of 36,479,243 kw-hours sold, 15,087,680 kw-hours were used for private lighting, 19,655,173 kw-hours for motors and heaters, and 1,556,661 kw-hours for public lighting, while the remaining 179,729 kw-hours were sold by contract. The energy was sold at the following rates:

Lighting:					
Shops, warehouses, offices, etc.	915	kw-hours at	16	cents	
Shops, warehouses, offices, etc.	7,885,833	" "	"	7	"
Shops, warehouses, offices, etc.	3,613,578	" "	"	7½	"
Domestic consumers, churches, schools.	1,804,107	" "	"	6	"
Special lighting	1,711,764	" "	"	3	"
Special lighting	71,483	" "	"	2	"
	15,087,680				
Industrial service:					
Motors and heaters	5,175,341	" "	"	3	"
Motors and heaters	9,011,794	" "	"	7½	"
Motors	1,172,238	" "	"	2	"
Motors	4,295 800	" "	"	7	"
	19,655,173				

A table is then given of the number of hours during which different consumers used electrical energy. This table shows a remarkable decrease in consumption by "short-hour" and what may be called "medium-hour" consumers, in spite of a considerable increase in the number of consumers. Perhaps the most gratifying feature is the increase in the sales of energy for heating, the increase of 75,674 kw-hours representing 54 per cent of the previous year's output. The total generating and distributing cost per kw-hour sold, without capital charges, was 1.460 cents; including interest and sinking fund, 2.728 cents, and including depreciation, 3.47 cents.—Lond. *Electrician*, Sept. 9.

Central Station in Brazil.—A. McPherson.—An illustrated description of the central station of Maceio, a city of 35,000 inhabitants, in Brazil. Only 1.5 per cent of the population are consumers of the station. The rating of the plant is 300 kw, the single-phase system being used.—Lond. *Elec, Review.* Sept. 9.

Wires, Wiring and Conduits.

Underground Cables for High Tensions.—M. J. Grosselin.—The author first quotes several opinions which have been expressed on the impossibility of using underground cables for long-distance transmission at very high tensions, and then refers to the fact that 40,000-volt cables are in successful use at two places in France. At the Girod plant at Ugine there are 2.6 km (1.6 miles) of $3 \times 40{,}000$-volt cable, while the Grenoble Lighting & Power Company has 4.5 km (2.7 miles) of the same cable. The author discusses the limitations of the construction of three-conductor and single-conductor cables and finds that the former can be built up to 50,000 volts, the latter up to 67,000 volts. The capacity effects and the possibilities of a dangerous rise of voltage are then discussed, and the author concludes that long-distance transmission by underground cables at from 50,000 volts to 67,000 volts is possible if transformers with a one-to-one ratio of transformation are inserted to take care of the charging current and to dampen excessive voltages. Some estimates of cost are added.—*La Revue Elec.*, Aug. 15,

Tests of High-Tension Insulators.—W. Weicker.—The conclusion of his paper on the conditions of weather, etc., which are of especial importance for the discharge of high-tension insulators. The amount of humidity in the air is a factor of prime importance, but is often neglected in laboratory experiments. The following losses of a 6500-volt insulator were observed under different weather conditions: In dry air, 0.05 watt; in slight fog, 0.15 watt; in snowfall below 0 deg. C., 0.25 watt; in strong thunderstorm rain, 1 watt; in a long-lasting rain with high humidity in the air, 1.1 watts; in a blizzard-like thunderstorm rain 1.5 watts; in heavy snowfall, mixed with rain above 0 deg. C., with simultaneous strong wind, 2.2. watts. Wet snow, therefore, represents the most unfavorable condition for a high-tension insulator. The suitable arrangement of insulator tests so as to approach the conditions of practice is discussed.—*Elek. Zeit.*, Sept. 1.

Hermetically Sealing Iron Wire into Glass.—(See the abstract of the paper by Sand above, under Lamps and Lighting.)

Electrophysics and Magnetism.

Electrotonic Theory.—A note on a recent paper by J. A. Crowther on the scattering of homogeneous beta rays and the number of electrons in the atom. In this investigation the scattering of a homogeneous pencil of beta rays was measured for various substances and for rays of different velocity. It was shown to obey the following laws: For rays of given velocity the intensity I of the radiation contained within a given cone may be expressed by the equation $I/I_0 = 1 - e^{-kt}$ where t is the thickness of the material and k a constant depending upon the angle of the cone. For rays of given velocity the most probable angle of emergence was proportional to the square root of the thickness of material traversed by the rays. For rays of different velocities the probable angle of emergence divided by the square root of the thickness traversed was inversely proportional to the product of the mass of the incident beta particle into the square of its velocity. From equations given by Sir J. J. Thomson the number of electrons contained in atoms of different elements was deduced. It was thus found that the ratio of the number of electrons per atom to the atomic weight was constant, the ratio being very nearly 3.0 for all the elements examined; that the positive electricity within the atom was not in an electronic condition, but was distributed fairly uniformly over the space occupied by the atom. Experiments were also described on the absorption of homogeneous beta rays. It was shown that the first stage in the absorption of a pencil of homogeneous beta rays consisted in the scattering of the rays according to the laws already considered. The absorption of the completely scattered radiation was then shown to take place according to an exponential law. —Lond. *Electrician*, Sept. 2.

Electrochemistry and Batteries.

Bleaching Liquor as a By-Product of an English Central Station.—An article on the production of calcium hypochlorite (bleaching liquor) by electrolysis in connection with the Poplar municipal central station. This plant reported on consists of forty cells through which salt water is circulated, the cells being run in series on a 220-volt circuit and taking from 16 amp to 25 amp. The plant is in duplicate. These two plants can deliver in eight hours 400 gal. of hypochlorite solution at a strength of from 4.5 grams to 6.1 grams of chlorine per liter. The output per month during 1909 varied from 658 gal. in December to 4326 gal. in August, or 173 gal. per working day. The cost of material on a yearly output of 27,216 gal. was $265.55, electricity costing $149.40. The bottles used for distribution are charged for extra. A fresh use for the disinfectant has also been found in the public baths of the district, where it is used to eliminate any danger of infection being spread in the bath, as well as to oxidize the various impurities given off into the water before it is changed; 70 gal. of 2.5-grams solution is added to a 70,000-gal. bath. This, which in any case is a commendable precaution, may easily come to be regarded in the case of populous districts as a necessity. From the central-station engineer's point of view a fair-sized motor would doubtless provide a more satisfactory load. But if a municipality has to buy disinfectants it is better to make them in its own central station. The hypochloride solution is chiefly used in Poplar for sterilizing the water in swimming baths, street watering (of course, in a highly diluted form) and for distribution by the public health department in cases of outbreaks of infectious diseases.—Lond. *Electrician*, Sept. 9.

Electric Steel Furnace Plant.—H. Thieme.—After a short discussion of the principal features of the electric induction furnace for steel making, a detailed illustrated description is

given of the electric steel plant of the Eicher-Hüttenverein Le Gallais-Metz & Company, in Dommeldingen, Luxemburg. In the present instalment the electric power plant and the construction of the electric furnace are described. There are two single-phase furnaces, each from 3 tons to 4 tons rating, and a

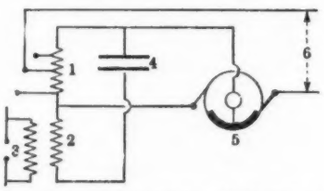


Fig. 3—Diagram of Arrangement for High-Tension Discharges.

three-phase furnace of 1½ tons rating. The article is to be concluded.—*Elek. Zeit.*, Sept. 8.

Units, Measurements and Instruments.

High-Tension Discharge.—E. WILSON AND W. H. WILSON.—A paper read before the British Association on a new apparatus for using high-tension discharges suitable for direct connection with an alternating-current supply circuit. The principle is shown in Fig. 3. Energy is stored in a magnetic field by an inductance 1. It is then permitted to surge into a condenser 4, which forms with the inductance 1 a low-frequency oscillatory circuit. When the energy is accumulated in the condenser 4 the latter is mechanically bridged across the primary winding 2 of an induction coil with which it forms a high-frequency oscillatory circuit. The energy is then transmitted by the secondary winding 3 of the induction coil to the work circuit, and can be of an oscillatory or unidirectional character, according to the purpose in view. The above cycle of events is controlled by a contact maker 5, which is driven by a small motor arranged with commutator and slip-rings so that the apparatus can be worked when the mains 6 supply either direct or alternating current. Tapping points on the inductance 1 allow of a suitable range of voltages being used. At "make" the system is switched onto the supply mains, the current rises in the winding of the inductance 1 and builds up the magnetic field. When sufficient energy has been stored the system is severed from the mains and this may be referred to as the epoch of "break." As only the current in the condenser 4 passes through the primary winding 2 the inverse e.m.f. induced in the secondary winding 3 is so small as to be negligible, but if desired it can be entirely eliminated by a modificaton in the connections. At the epoch of "break" the energy stored in the condenser 4 is added to that in the inductance 1, and then the total energy in the inductance 1 begins to surge into the condenser. At the precise epoch when the condenser has received the whole of the energy in virtue of its reverse charge the contact maker 5 short-circuits the inductance 1. The condenser then discharges with great rapidity through the primary winding 2, and the energy then oscillates between the condenser and primary winding in the well-known manner.—Lond. *Electrician*, Sept. 9.

Weston Cell.—In a report to the British Association results are given of an investigation made at the National Physical Laboratory concerning the limits of temperature between which

Percentage of Cadmium in the Amalgam	Lower Limit, Deg. C.	Upper Limit, Deg. C.
6	Below 0	About 27.7
7	"	" 34.6
8	"	" 41.0
9	"	" 46.0
10	"	" 51.0
11	About 0	" 56.0
12	" 8.7	" 60.0
12.5	" 12.1	Above 60.0
13	" 16.1	" 60.0
14	" 24.0	" 60.0
15	" 32.5	" 60.0

various cadmium amalgams may be most usefully employed in the Weston standard cell. The above table shows the results. The degree of reproducibility which is now obtainable with the Weston cell far surpasses that of five years ago. At the National Physical Laboratory 67 cells were tested in 1909, and of these 60 agreed with the laboratory standards within 1 part in 10,000. What is not understood at present is the occurrence of strange hysteresis effects in a few cells (see below).—Lond. *Electrician*, Sept. 9.

Weston Standard Cell.—An editorial note on hysteresis effects in some Weston cells, to which reference is made in the report of the electrical standards committee of the British Association. Cells which exhibit marked hysteresis effects invariably change with time at a comparatively rapid rate. The cause of the hysteresis seems to be different from that observed, many years ago, in the case of the tube form of Clark cell, for in the latter case the irregularities appeared to be chiefly due to a difference of concentrations of the zinc sulphate solution at the anode and cathode. But, as the Rayleigh H form of vessel is used for the Weston cell, a difference of concentration in the cadmium sulphate solution at anode and cathode is very improbable. If a Weston cell in which the hysteresis effect occurs is raised in temperature, the decrease in e.m.f. is, in general, very nearly normal; but when afterward the temperature is lowered the increase in e.m.f. is abnormal. All cells sent for test at the National Physical Laboratory are examined for this hysteresis effect, and no certificate is granted if the effect exceeds a certain limit. For the purpose of the test the cells are kept at a constant temperature for a few days and their e.m.f. measured; afterward, the temperature is increased 10 deg. C. and the cells maintained at this temperature for twenty-four hours. The cells then cool in a normal manner to the initial temperature and after two days the e.m.f. is again measured. If this disagrees with the e.m.f. first observed by 0.0001 volt or more the cell is regarded as abnormal and no certificate is granted. Comparatively few cells fail in this test; in many cases there is absolute agreement between the initial and final values of the e.m.f.—Lond. *Electrician*, Sept. 9.

Alternating-Current Galvanometer.—W. E. SUMPNER AND W. C. S. PHILLIPS.—A paper read before the Physical Society of London. The authors describe a galvanometer for alternating-current circuits and resembling a moving-coil galvanometer in almost every respect except that its field is due to a laminated electromagnet excited by an alternating voltage. A specially shaped stamping is placed between the poles. The use of the instrument as a voltmeter and for comparing inductances and capacities is explained.—Lond. *Electrician*, Sept. 9.

Miscellaneous.

British Association.—This year's meeting has been held at Sheffield, beginning on Aug. 31. The president is Dr. T. G. Bonney. Abstracts of papers presented will be given, or are being given, elsewhere in the Digest.—Lond. *Electrician*, Sept. 9.

Neglect of Science by Commerce and Industry.—An account of a discussion held at a joint meeting of the Chemical and Educational Science Sections of the British Association. Mr. R. Blair in opening the discussion said that one of the main defects of college training is neglect of the question of cost in design and the commercial side generally. All engineering firms exist for the purpose of making a profit, and modern conditions render it essential that all technical students should fully realize the importance of economical design and cheap maintenance. Employers want men who can in their designs give the most for the money. It is quite insufficient to teach design on physical principles alone. Methods of production, ease of repair, depreciation, and even conditions of transit in large machines, should all be taught in connection with effective design. On the other hand, in order that heads of firms should more fully appreciate the need for science in business, he recommends special courses in technical training for them. He deplores the lack of application of scientific principles to canvassing the various markets of the world, a matter to which attention is being called repeatedly by British consuls abroad.

Another suggestion is that consultative committees should be attached to all faculties or departments, such committees to be advisory, and to be composed of commercial leaders and business experts of the highest reputation. Probably this is the best way of enlisting the sympathy of industrial and commercial men. Subsequent speakers included Sir W. Tilden, Dr. H. T. Bovey. Dr. E. H. Griffiths, Sir William White, Mr. J. E. Stead and Prof. E. H. Armstrong. Sir W. Tilden thought the greatest ignorance on the part of employers in relation to science was to be found in the electrical and chemical industries. He supported this statement by a reference to the exceedingly low salaries frequently offered to fully qualified men. He also criticised the government in this connection and said it was impossible to find an official, from a cabinet minister downward, holding a superior administrative position who had received an education in which physical science had formed any substantial part. The measure of parliamentary sentiment in favor of science is to be found in the moderate grants made for this purpose. The Imperial College of Science is quite inadequately endowed. Dr. H. T. Bovey said the only means of securing the universal application of science to industry is by the organization and centralization of technical education. In America it is essential for a young engineer to have received a diploma in some technical institution of repute before he can obtain employment. Sir William White and other speakers differed from the view that England is behind other countries in the application of science to industry. Principal Griffiths depreciated abuse of the industrial leaders. There are faults on both sides, and the cause of the present unsatisfactory state of affairs is the lack of means of communication between those working in the universities and the commercial men. If the universities cannot provide the type of men required in business they must put their house in order. The need for co-operation was supported by other speakers. Sir William White suggested that a laboratory should be attached to all commercial undertakings, a policy which has led to some remarkable results in the steel industry.—Lond. *Elec. Eng'ing*, Sept. 8.

Book Review.

Children's Diet in Home and School. By Mrs. Louise E. Hogan. Revised edition. New York: Doubleday, Page & Company. 194 pages. Price, 75 cents.

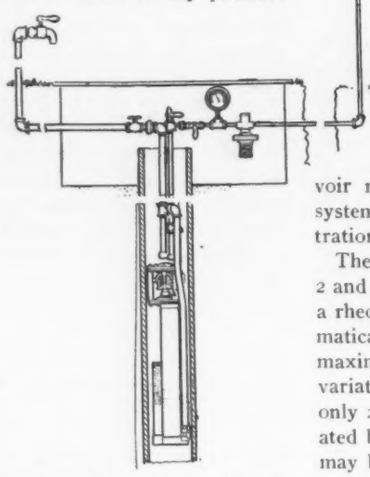
As indicating the growing recognition of electric heating it is interesting to note that the revised edition of this well-known little book on children's diet contains a section devoted to electric cooking and several other applications of electric heat, such as to milk warming, pasteurizing, etc. A considerable number of recipes are included for the preparation of nursery foods in the electric chafing dish, and indications are given to recipes in other sections of the book to which electric utensils may be applied. We are told that a number of central-station companies have purchased editions for special complimentary distribution among their residential customers with families.

New Apparatus and Appliances

ELECTRO-PNEUMATIC WATER-SUPPLY SYSTEM.

As one feature of a water-suppply system for furnishing water from a well or other source of supply, without storage, by air pressure, Mr. Thomas O. Perry, of Chicago, has invented an automatic electric controller which is of considerable interest. In general terms the Perry automatic water system comprises an electric motor or other source of power, driving an air compressor which stores air in a tank from which a pneumatic pump submerged in the well is driven. By means of this pump water is supplied to lines of piping with faucets, and the water is, therefore, available "fresh from the well," without storage, whenever needed.

The motor, compressor and tank may be located at any convenient place. Having connected these properly and started the compressor, the air is stored in the tank to any pressure desired and then the compressor is stopped. The compressed air operates the pump and is used only when water is drawn from the faucets. It is not necessary to start the compressor again until the air reservoir requires re-charging. A pressure reducer on the air line maintains an even pressure of water at the faucets, regardless of the amount of air pressure in the tank, down to a predetermined minimum pressure. It is, therefore, necessary to operate the motor only intermittently when the pressure in the tank, as shown by a gage, falls to a certain point. The Perry electric controller is used to start or stop the motor connected to the air compressor when the air pressure in the tank reaches a certain minimum or maximum.



Where electric service is available the use of an electric motor for driving the compressor is always recommended. By the use of the electric drive a comparatively small air reservoir may be used, as the automatic controller regulates the system closely within any desired limit. Fig. 1 is an illustration showing the entire system arranged for electric drive.

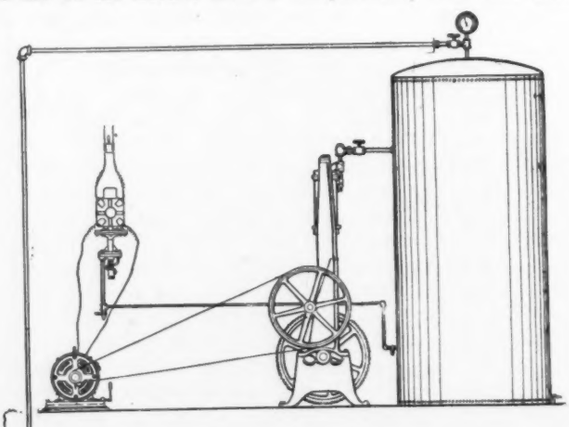


Fig. 1—Electro-Pneumatic Water Supply System.

The Perry electric controller, which is shown clearly in Fig. 2 and also in Fig. 3, where it is arranged to operate the arm of a rheostat, is designed to start and stop an electric motor automatically by the variation of pressure between predetermined maximum and minimum values. It may be operated on a wide variation between starting and stopping, or on a difference of only 2 lb. or 3 lb., if desired. As usually employed, it is operated by air pressure, but the pressure of water or other liquids may be used instead. As patented, it is spoken of as a "fluid pressure controller." It is provided with two diaphragms, and the air is admitted to the upper diaphragm through a valve controlled by the pressure on the lower one. This action

allows the full pressure to act directly upon the mechanism controlling the switch.

While the pressure is increasing it gradually compresses a spring the force of which is conserved by means of a latch until a predetermined value is reached, when it is automatically released. This action allows the full force of the spring to

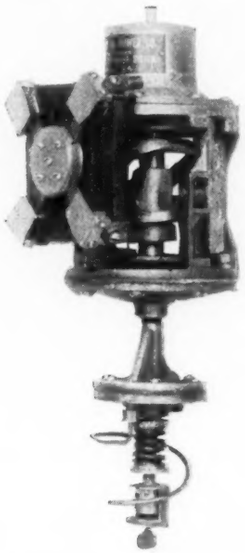


Fig. 2—Electric Controller for Small Motor.

operate the blades of the switch, instantaneously breaking the circuit. When the pressure is again lowered to a given point the action is reversed, the same instantaneous action closing the circuit. That is in principle the operation of the controller as shown in Fig. 2, which may be installed as illustrated for small series-wound direct-current motors of ½ hp or less, for which no starting box is required. For larger motors, or where a starting box is necessary, the controller is connected

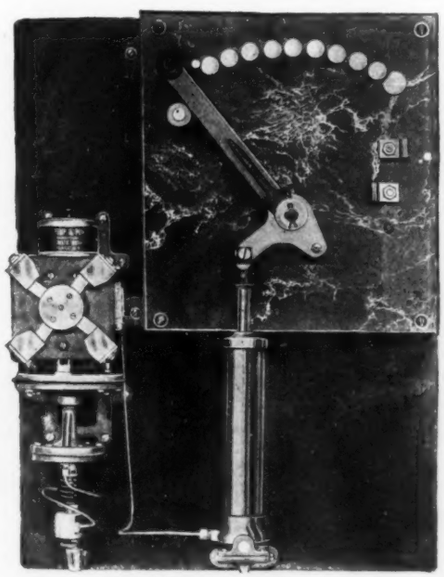


Fig. 3—Electric Controller Attached to Rheostat Arm of Larger Motor.

to a small pneumatic cylinder, as shown in Fig. 3, by means of which the arm of the rheostat is moved to start or stop the motor as before. The Underwriters' Laboratories have approved the operation of the controller, which is supplied with a metal enclosing case, not shown in the illustrations.

The operation of the electro-pneumatic controller with its two diaphragms is very similar to the operation of the Perry pneumatic pump, which consists of two cylinders, connected by a head, adapted to be alternately filled with water and emptied by the use of automatic valves closely resembling those used in the controller and designed in the same way to be operated by the pressure of the air itself. It is asserted by the United Pump & Power Company, Old Colony Building, Chicago, which manufactures the Perry pneumatic water system, that the cost of supplying water with the compressor driven by an electric motor is less than 2 cents per 1000 gal. where the lift is 50 ft. and the rate for electrical energy is 12 cents per kw-hour. The system is designed, of course, to be used where water from public water works is not available. In many country homes and similar locations however, electricity may be had where water from street mains is not obtainable. The system is of interest to central-station managers, therefore, as a possible source of new business.

While the size of the motor will depend on the conditions, such as the lift and amount of water required, it is said that a ½-hp motor will be sufficient to operate a water system for supplying 500 gal. an hour, which is usually sufficiently large for the ordinary rural home or farmstead. For larger plants the power required is proportionately small, a 10-hp motor being sufficient to supply 300,000 gal. per day.

PORTABLE RAILWAY SUBSTATION.

The Westinghouse Electric & Manufacturing Company recently completed for the Fort Wayne & Wabash Valley Traction Company a portable substation which is now in operation on the latter company's electric lines in the vicinity of Fort Wayne, Ind.

The general arrangement of the electrical apparatus in the car includes no great departure from previous practice. The lightning arresters are located at one end of the car; close to this end are the oil circuit-breaker and the transformers; the switchboard is near the center, and the rotary converter is near the other end. A liberal space is allowed near the switchboard in the middle of the car, and there are no high-voltage wires in the neighborhood of the board; hence safety is secured for the operator.

The dimensions of the all-steel car are: Length over end sills, 40 ft.; width over all, 9 ft. 5 in.; truck centers, 27 ft., and height, from floor to underside of roof at center, 8 ft. 9 in.

The 500-kw, 500 r.p.m., 550-volt, six-phase, 25-cycle rotary

Fig. 1—Exterior of Car.

converter is of standard construction. The switchboard comprises two panels of black marine-finished slate. The 10-amp. three-pole, 35,000-volt, oil circuit-breaker is operated by hand from the switchboard; thus, distant control of the high-tension, incoming line is provided. The three-phase transmission circuit, of 33,000 volts and 25 cycles, is brought into the car

through three 300-amp, 33,000-volt single-pole disconnecting switches.

There are two 33,000-volt, primary, lowering transformers

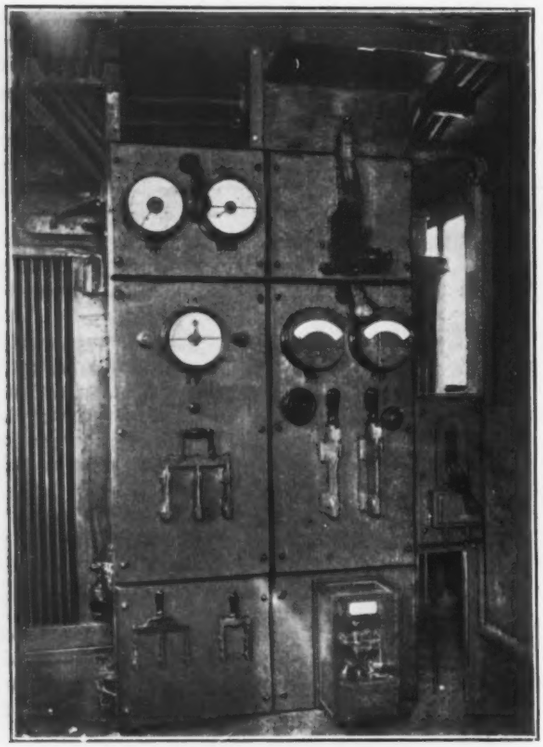
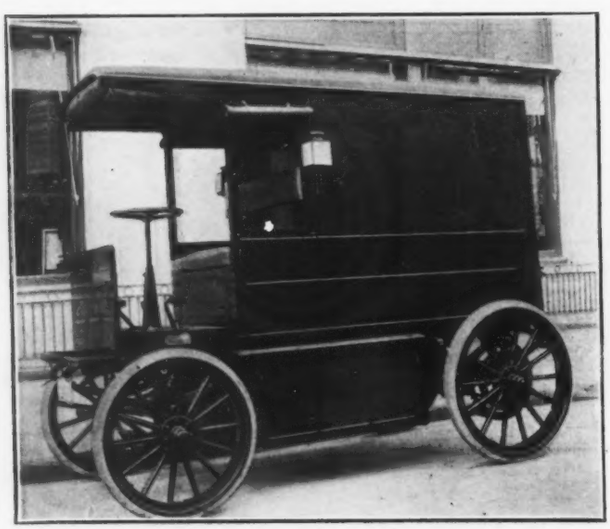


Fig. 2—Switchboard.

of the oil-insulated, self-cooled type; they are double-V connected. Three low equivalent lightning arresters are provided.

ELECTRIC VEHICLE FOR TRANSPORTATION OF GUNPOWDER.

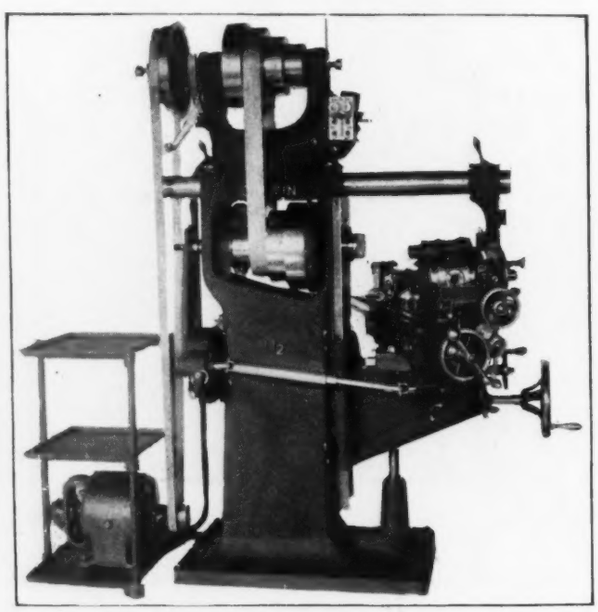
The Studebaker Brothers Company, of New York, is making delivery to the Union Metallic Cartridge Company, of Bridgeport, Conn., of one of its electric vehicles, which has some features in its equipment adopted because of the dangerous nature of the load to be carried. The matter of a suitable vehicle for the transportation of powder from the outlying powder houses to the manufacturing establishment of the Union Metallic Cartridge Company has been under consideration for about a year and a half, and as the result of consultation with the Studebaker engineers it was proved that an electric wagon could be so equipped as to insure absolute protection against any danger from ignition of the powder. The compartment of the vehicle in which the powder will be carried is practically hermetically sealed and is so constructed that there is no metal exposed in a way to cause danger of friction and consequent ignition. The controller and the other portions of the apparatus at which sparking is likely to take place under ordinary circumstances have been immersed in oil, and all the wiring of the vehicle has been placed in metallic conduit with the greatest care possible to ensure safety. This machine is equipped with sixty-four cells of Edison battery and the vehicle will be run over the road from New York to Bridgeport in making delivery to prove its practical utility in every particular. Conditional upon the satisfactory performance of this machine the Studebaker Company has orders for additional equipment. This case is another illustration of the adaptability of the automobile to new fields and the characteristics of the electric machine render it alone serviceable in this instance.



Electric Vehicle for Transportation of Gunpowder.

MOTOR MOUNTING FOR UNIVERSAL MILLING MACHINE.

In the accompanying illustration is shown a method for belting a motor to a milling machine in such a way that the mount can be attached to a machine in stock, thus avoiding the expense and delay which might otherwise arise in covering the motor-drive requirements. The motor drives by a narrow, high-speed belt a two-speed cone which is back-geared to the main upper four-speed cone through a double-gear system, thereby providing a total of sixteen speeds. Both of the overhead cone pulleys run on a stationary shaft stud that is made hollow to allow of supplying the lubricant from grease cups at the two ends. This shaft is keyed to the eccentrics, one of which has a segment worm-gear under control of a crank. This scheme is used to give the proper tension to the belt so that it may be eased off for shifting purposes. The connection from the spindle to the rotary-feed change box is by chain. The total weight of the equipment illustrated is 2450 lb. It is built by the Garvin Machine Company, Spring and Varick Streets, New York.



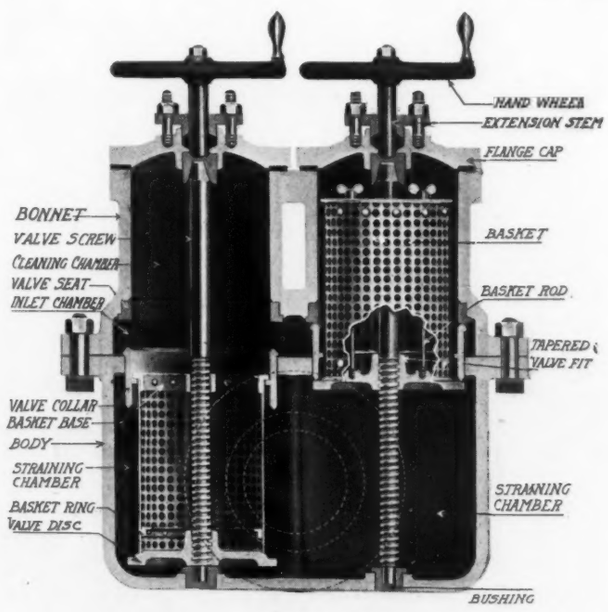
Motor Mounting for Milling Machine.

MULTIPLE STRAINERS.

Nearly all sources of water supply, especially for circulating water, contain a certain amount of suspended matter, and attempts are often made to remove this by placing a strainer around the suction pipe foot valve. The strainer soon becomes clogged and it is necessary to shut off the pumps while it is being cleaned.

In order to get around these difficulties the Lagonda Manufacturing Company, of Springfield, Ohio, has recently placed on the market a multiple strainer for removing impurities in feed water, circulating water, etc. These strainers can be installed either outside or inside the buildings and in any position, horizontal, vertical or inclined. They are made up of different sections which can be cleaned, one at a time, without interrupting the flow of water. The strainer consists of a cast-iron body having a number of removable strainer baskets, the number depending upon the size of the line.

Referring to the accompanying illustration it will be seen that the water enters through the inlet pipe and passes up to the top of the valve chamber, where it divides, going down through all of the baskets in multiple. When it is desired to clean the strainer, one of the baskets is drawn to the upper part of the chamber by turning the hand-wheel; at the same time the valve collar is forced tightly against the valve seat and the valve disk on the bottom of the basket seats on the valve collar. This action entirely shuts off the water supply from the section containing the basket to be cleaned. By means of a small bypass the pressure in this chamber is now relieved and the bolts at the top loosened and the flange cap tilted over, thereby exposing the basket. The basket can now be taken out and cleaned. In replacing the basket the operations are exactly the



Multiple Strainer.

reverse. The next basket can now be removed in the same way and the whole strainer cleaned without shutting off the water.

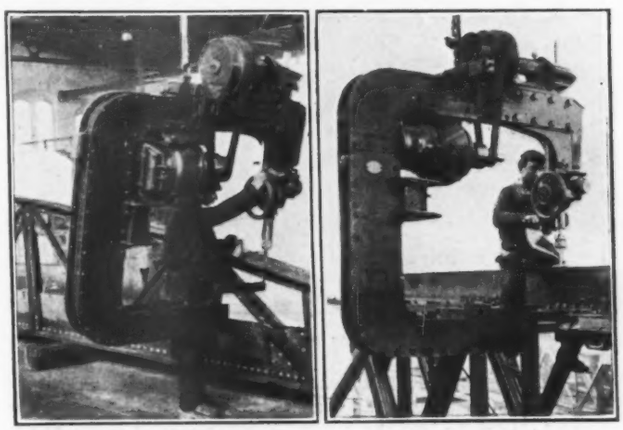
The effective straining area of a Lagonda strainer is from 2.2 to 4.0 times the area of the pipe line, and in removing one basket for cleaning the straining area is not reduced more than 30 per cent, and therefore the pipe line is never throttled in the process of cleaning.

The strainers are built in sizes from 2 in. to 48 in., having from two to six baskets, the number depending upon the size of the strainer. They are also suitable for use in either suction or pressure lines and are built to withstand working pressures up to 200 lb. per square inch. In practice one of the baskets is left out of service so that in case the baskets in use should become clogged the clean basket can be quickly lowered into service.

AN ELECTRIC PENDULUM DRILL.

While portable electric drills are finding a rapidly growing variety of applications in shops of various kinds, their use in this country has been confined chiefly to light work for which the operator can carry the device from place to place, using breast pressure to feed the drill. Of course, such a limitation in capacity could not last long for so convenient a device as the portable drill, and already several manufacturers are planning to supply the need for similar devices of far greater power.

Among the first of these is the electric crane builder of Berlin, Carl Flohr, who is offering what he calls a "pendulum



Electric Pendulum Drill.

drilling machine" for use wherever it is more feasible to move the drill than the pieces that are to be bored. To make it generally adaptable, the frame of the drill is hung from a traveling crane by a stirrup on which the loop can be shifted so as to tilt the frame to an angle. This tilting adapts it admirably for drilling structural steel trusses. Interchangeable extensions on the lower end of the frame brace the work against the drill so that a power feed can be used to save time, while the pressure is ample to prevent superposed plates from slipping on each other during the drilling.

Comparisons in shops under actual manufacturing conditions are said to have shown that such a suspended drill bored from 1000 to 1200 ⅜-in. holes a day, as compared with from 700 to 800 holes in the same class of structural work when the latter had to be moved along a stationary drill press. The moving of the structure would undoubtedly be slower and more costly than that of shifting the suspended drill, hence the total difference in the cost of drilling would not be in the number of holes per day. For ordinary drills the machine is fitted with a 2.4-hp motor belted through cone pulleys to give speeds of 75 r.p.m., 180 r.p.m. and 300 r.p.m., with corresponding power feeds of about ½ in., 1¼ in. and 2 in. per minute (12.5 mm, 30 mm and 50 mm). For high-speed drills a 5-hp motor is used with two-speed cones giving either 300 r.p.m. or 400 r.p.m. with power feeds of about 2.75 in. and 3.50 in. respectively (67.5 mm and 90 mm). In either case the machine has an effective 12-in. opening and takes drills having diameters up to 1.25 in. The total weight with the lighter motor is about 1650 lb. (750 kg), or fitted with larger motor for high-speed drilling about 1870 lb. (850 kg).

For work which cannot be reached from the ground the operator can straddle the structure. The maker claims that by drilling holes for most of the rivets in trusses with such a suspended drill after the parts are assembled, much of the time otherwise required for laying out the rivet holes is saved and the chance of having holes out of line is reduced to a negligible factor, thus saving time in the riveting and permitting the use of cheaper labor on this class of work.

GENERAL UTILITY MOTOR.

The general utility motor now being placed upon the market by the Westinghouse Electric & Manufacturing Company marks another advance of the application of electricity to household convenience. By means of its special attachments the motor can be adapted to a variety of uses about the house,

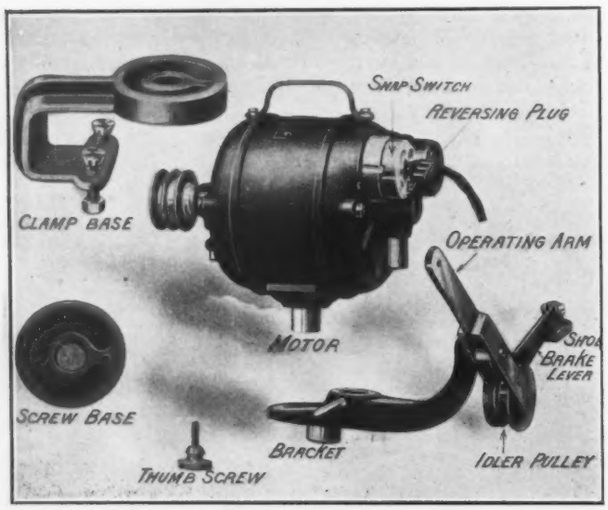


Fig. 1—Motor and Attachments.

and thus commends itself heartily to the favor of central-station companies as providing another wedge for the introduction of electricity into the home. Furthermore, it is essentially a day load. The motor takes from 40 watts to 120 watts for its operation.

The general utility motor can be readily arranged to operate the following devices: Family sewing machine, buffing, polishing and grinding wheels, ventilating blower, jewelers' lathe, light machinery, small lathes, sign flasher, moving win-

Fig. 2—Motor Operating Sewing Machine.

dow display, mechanical toys, etc. The motor is sold complete with one or more attachments, and further attachments can be obtained by the purchaser as desired. A different attachment is not necessary for every one of the uses mentioned above, as some of the attachments make the motor available for several purposes without change. The general utility ventilating outfit is one of the features of the new apparatus. The small blower will supply fresh air to the kitchen, increase the draft of a furnace, remove foul air from sick rooms, and readily adapt itself to any small ventilating work. By fitting the blower openings with suitable pipe, air currents can be directed wherever desired.

The general utility motors are made for operation on 115-

Fig. 3—Motor-Operated Ventilating Blower.

volt and 230-volt direct-current circuits, and on 110-volt and 220-volt alternating circuits of 60 cycles and 133 cycles. The direct-current motors are shunt-wound, while the alternating current motors are of the induction type, single-phase. The motors run at a speed of 1700 r.p.m. The motor is light and

Fig. 4—Polishing Tableware.

can be easily carried from place to place by means of a handle in the top of the frame. It is artistically finished in black enamel to harmonize with the other house decorations. The applications of the attachments are positive, and it is impossible to put them on wrong.

PACIFIC COAST ELECTRICAL EXPOSITION.

The first electrical exposition held on the Pacific Coast and probably the largest held west of Chicago successfully opened at the Coliseum in San Francisco on the evening of Sept. 17. With nearly a hundred exhibit booths and approximately 30,000 sq. ft. of floor space actually occupied by exhibits, and a line of apparatus, supplies and features shown that could hardly be surpassed in the East, the exposition may be said to have been a success and a credit to its promoters.

The exposition had its inception over a year ago when a number of representatives of the different electrical trades in San Francisco organized and laid plans to hold a show in the old Coliseum during December, 1909. Previous exhibitions of a portable nature, showing electric lighting, heating and cooking appliances, had been held by the local lighting companies in San Francisco, but the time was deemed ripe for an exposition along the lines of the shows that had been held in New York, Chicago and other Eastern cities. The plans progressed favorably, but unfortunately the old Coliseum was destroyed by fire before the date of opening, and as no other building in the city was large enough the project had to be postponed until the new Coliseum was completed.

Fig. 1—San Francisco Electrical Exposition.

The new building, only just completed and dedicated by this exposition, is located on Page, Baker and Oak Streets, opposite the Pan Handle of Golden Gate Park. It has 60,500 sq. ft. of floor space 37,620 sq. ft. of which is under the dome and entirely free from columns or other obstructions. Special attention was given by the management to the apportionment of space, arrangement of booths and aisles and the general decorative scheme of the booths. Each booth was marked off by square white columns ornamented by simple but effective capitals, and judicious restrictions as to projecting displays, signs and decorations helped to make the general appearance of the hall very pleasing.

The general lighting of the hall was furnished by means of 500-watt tungsten lamps, this being the first time that such a large area has been lighted by lamps of this size. The lamps were also the first to be shown on the Pacific Coast. There were fifty-four lamps installed, they being contributed by the General Electric and Westinghouse companies and National Electric Lamp Association. They were supported in twelve rows across the hall and fed in multiple on a 118-volt alternating circuit, the energy being contributed by the San Francisco Gas & Electric Company. For exterior illumination at the entrance there were installed arcs of the flaming, intensified, luminous and metallic-flame types, the lamps being furnished by the exhibitors.

For the exhibitors' use there was installed a complete system of distribution under the floor with distributing cabinets at convenient locations. To each exhibitor was furnished all the energy he needed of either direct or alternating current, meters being installed for the individual booths at distributing centers. The direct current was supplied on a 110-volt, two-wire system from a Westinghouse motor-generator set.

The energy was received from the San Francisco Gas & Electric Company's 11,000-volt, three-phase distribution system, being transformed to 118 volts by means of four transformers located just outside the building. Electricity was carried to the 110-volt and 220-volt, two-phase system inside the building by means of six 500,000 circ. mil rubber-covered cables. The total load on the building was 200 kw.

The exposition management was vested in an executive committee consisting of Messrs. W. W. Briggs, of the Westinghouse Electric & Manufacturing Company, chairman; John R. Cole, John R. Cole Company, vice-chairman; J. A. Vandegrift, Oakland Warehouse Company; Albert H. Elliot, secretary and treasurer; W. W. Hanscom, consulting electrical engineer and director of exhibits, and D. M. Moses, general manager. It was almost entirely to the indefatigable work of these gentlemen that the success of the exposition was due.

The method of financing and conducting the exposition was a co-operative one, each exhibitor taking space becoming a stockholder in the enterprise. Space was rented at 50 cents a square foot and the total of nearly 30,000 sq. ft. rented provided sufficient income to finance the exposition, paying all expenses, including the commission for the general manager. An admission fee of 50 cents was charged to the public and the receipts from this source will be distributed pro rata among the exhibitors, so that with an anticipated attendance of 30,000 the exposition will entirely pay for itself. On the opening night there was an attendance of about 7000, and the indications were that the 30,000 mark would be reached before the week was over, the closing day being Sept. 24.

Practically every electrical manufacturing firm or dealer in San Francisco was represented at the exposition, and the exhibits included the newest and latest in lamps, motors, generators, switchboards, wire, batteries, vehicles, telephones, musical instruments, insulating materials, novelties, specialties, etc.

Fig. 2—San Francisco Electrical Exposition.

Prominent among the exhibits were those of the City of San Francisco, Southern Pacific Company, San Francisco Gas & Electric Company, City Electric Company, National Electric Lamp Association, General Electric Company, Westinghouse Electric & Manufacturing Company.

The complete list of exhibitors is as follows:

Allen Co., L. B., Chicago.
Amer. Conduit Mfg. Co., Pittsburgh.
American Elec. Fuse Co.
American Ever Ready Co.
American Faucet Co.
American Ironing Mch. Co.
Amer. Steel & Wire Co.
Apple Elec. Co., Dayton.
Auto Maintenance & Mfg. Co.
Aylsworth Agencies Co.
Babcock Elec. Carriage Co.
Baker & Hamilton.
Baker Motor Vehicle Co.
Barker, James, Co., Inc.
Bay Cities Electric Co.
Benjamin Electric Co.
Bossert Elec. Con. Co.

Brooks, Follis Elec. Corp.
Brumfield Electric Sign Co.
Burrell, D. H., & Co.
Burroughs Adding Mch. Co.
Cal. State Ass'n Elec. Contractors.
Cal. State Ass'n Elec. Cont.
Century Elec. Co.
City Electric Co.
Clark, Jas., Jr., Louisville.
Cole, John R., Co.
Collins Wireless Tel. Co.
Columbia Incandescent Lamp Co.
Columbus Vehicle Co.
Crocker-Wheeler Co.
Cutler Heater Co.
Cutler-Hammer Mfg. Co.
Cyphers Incubator Co.
Daggett, R. B., & Co.
Dean Electric Co.
Decker Elec. Co.
De Lux Electric Sign Co.
De Veau Tel. Mfg. Co., Brooklyn.
Direct Line Tel. Co.
Dossert & Co.
Drendell Electric Co.
Duntley Vacuum Cleaner Co.
Electric Cleaner Co.
Electric Launch Co., Bayonne N. J.
Electric Mfg. Co.
Electric Mfg. Co., New Orleans.
Elec. Ry. & Mfrs'. Sup. Co.
Electric Review and *Western Electrician.*
Elec. Storage Battery Co.
Electrical World.
Elec. Contractors' Association of California.
Engineering & Maintenance Co.
Ericsson, L. M., Tel. Mfg. Co.
Excello Arc Lamp Co.
Federal Sign Co.
Fred Fisher Co.
Ft. Wayne Electric Works.
H. F. Frosche Co.
General Acoustic Co.
General Electric Co.
General Elec. Const. Co.
German-Amer. Elec. Co., New York.
Grant Flaming Arc Co.
Gray Telautograph, New York.
Hanbridge Loyst Elec. Co.
Harvey Hubbell Co., Bridgeport.
Holabird-Reynolds Elec. Co.
Holophane Co.
Home Tel. Co.
Ideal Electric Co.
Johns-Manville Co.
Journal of Electricity, Power and Gas.
Jupiter Switchboard Co.
Keller Mfg. Co.
Kellogg Sw. Bd. & Sup. Co.
Kiewert, C. L., Co., Milwaukee.
Kimball Elec. Co., Chicago.
Klein, Mathias, & Sons.
Knobblock Hardeman Mfg. Co., So. Bend.
Kohler & Chase.
Krantz, H., Mfg. Co.
Laugenour Sales Co.
Levy Elec. Co.
Machado & Roller.
McDougald Mfg. Co.
Monarch Tel. & Mfg. Co., Chicago.
Moore, C. C., & Co.
National Dictograph Co.
National Elec. Lamp Ass'n.
National Indian Rubber Co.
N. Y. Insulated Wire Co.
Otis & Squires.
Pacific Electric Co.
Pacific Elec. Heating Co.
Pacific States Electric Co.
Pacific Tel. & Tel. Co.
Paraffine Paint Co.
Parrott & Co.
Pierson Roeding Co.
Pioneer Automobile Co.
Poss, P. H.
Rauch & Lang Carriage Co.
Reed Electric Works.
Reliance Automobile Co.
S. F. Compressed Air Cleaning Co.
S. F. Gas & Electric Co.
Sangamo Elec. Co., Springfield, Ill.
Santa Clara College.
Schwartz Elec. Co., Adrian, Mich.
Shawmut, Chase, Newburyport, Mass.
Simplex Electric Heating Co., Boston.
Smith, F. E.
Southern Pacific Co.
Sprague Electric Co.
Standard Underground Cable Co.
Stave Electric Co., N. Y.
Studebaker Bros.
Tel. Electric Equip. Co.
Thieben, Joseph, & Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
United Railways.
University of California.
Vacuum Specialty Mfg. Co.
Van Nort Carbon Brush Co., St. Louis.
Wagner Electric Co.
Walters Surgical Co.
Western Union Tel. Co.
Westinghouse Elec. & Mfg. Co.
Weston Elec. Instrument Co.

A brief account of the various exhibits follows:

Parrott & Company displayed the Grant flaming arc and the "Sunray" arc. They also had as an overhead illumination a line of Austrian clear-globe tungsten lamps, including 450-watt, 550-watt and 750-watt lamps.

The Aylsworth Agencies Company had in operation the Monarch time system with a secondary clock over the main entrance. Its exhibit also comprised Monarch telephones, Cooper Hewitt mercury-vapor lamps, Apple ignition and lighting system, Schwarze bells, "Nokorode" soldering paste and "All-in-One" ground clamps.

The Western Union Telegraph Company had a Barclay printing telegraph machine in operation and a Wheatstone apparatus, both of which attracted a great deal of attention. Its booth also contained quadruplex and duplex instruments, old and new instruments and a historical display showing the evolution of the battery. The merits of the night letter system were also demonstrated.

The Southern Pacific Company had a large space fitted up in its usual attractive manner. Two large semaphore stations were in operation, as well as a model of a complete block showing the operation of the block signaling system used on its lines. Automatic lantern machines and advertising signs showed various attractive views of scenery on the Southern Pacific route, while the company's advertising department was well represented with its splendid line of publications. Drawings and photographs of its new electrical work on the east side of San Francisco Bay were also on display.

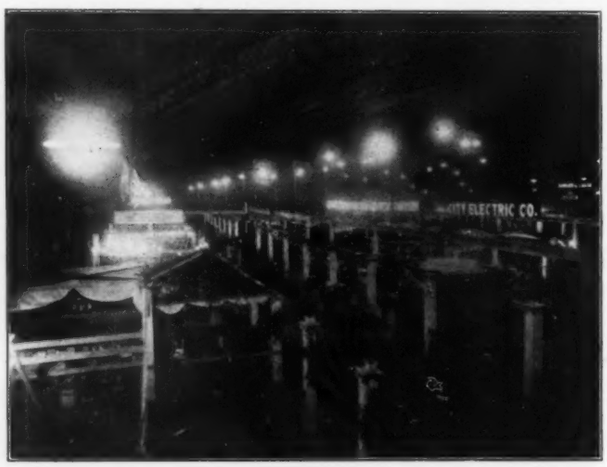


Fig. 3—San Francisco Electrical Exposition.

The San Francisco Gas & Electric Company, while having one of the largest booths in the hall, contented itself with a very attractive and home-like lounging and reception space, suitably decorated. Albums of views taken on its system were on exhibition.

H. W. Johns-Manville Company had an interesting exhibit of underground conduit, subway and aerial fuse and service boxes, asbestos wood which is becoming very popular on the Coast, pole-line insulating materials, porcelain, railway material, etc.

The City Electric Company had a model underground vault completely equipped with transformers, switches, junction boxes, etc. Of the company's own design and manufacture there was shown a 11,000-volt underground combined switch and fuse and a 500-volt, three-wire, large-capacity, six-way junction box.

The Burroughs Adding Machine Company showed eighteen of its seventy-one different types of adding machines, most of which were electrically driven.

The Benjamin Electric Manufacturing Company and the Holophane Company jointly occupied a booth and displayed the new "Stiletto" type of high-efficiency reflectors, enameled steel reflectors for tungsten lamps of 16 cp to 500 watts for factory and interior lighting, the series cluster body, the new street series type, as well as the well-known Benjamin fixtures.

The American Steel & Wire Company showed a large and well-arranged display of bare copper, weatherproof wire and cable; galvanized iron and copper telephone and telegraph wire, bare and insulated; rubber-covered wire and cable; magnet wire; lamp cord; annunciator and office wire; galvanized

guy and messenger strand; pole steps; submarine cable; rail bonds and rail bond tools; all the goods displayed being taken out of San Francisco stock.

The AMERICAN ELECTRIC FUSE COMPANY, through its local agents, STEWART-FULLER COMPANY, showed Allan-Bradley rheostats, American enameled wire, telephone protection, spark and wireless coils, while the Stewart-Fuller Company exhibited Vulcan electric soldering and branding appliances.

The BROOKS, FOLLIS ELECTRIC CORPORATION included in its attractive booth a complete line of electrical supplies and novelties, lighting fixtures, Golden vibrators, a San Francisco product, etc.

The VACUUM SPECIALTY MANUFACTURING COMPANY, of San Francisco, demonstrated its Monarch renovator, a cleaning apparatus which weighs but 25 lb. and operates on the turbine principle.

R. B. DAGGETT & COMPANY exhibited a Walker electric truck, two Baker electric coupés and a Baker electric runabout. The Reid headlight and reflector and Sangamo amp-hour meter were also shown.

HOLABIRD-REYNOLDS COMPANY and PACIFIC ELECTRIC HEATING COMPANY showed a full line of electric irons and high-tension insulators.

The CUTLER HEATER COMPANY, of California, had on exhibition its Cutler electric hot-water heater.

The IDEAL ELECTRIC COMPANY showed an electric brougham that will seat four persons with ease.

COLUMBUS ELECTRIC AUTO COMPANY showed an electric roadster.

The RELIANCE AUTOMOBILE COMPANY showed the Detroit electric coupé, the PIONEER AUTOMOBILE COMPANY the Babcock, and the MCDOUGALD MANUFACTURING COMPANY the Rauch & Lang electric vehicle. Edison storage batteries were also exhibited in several of the booths.

The TELEPHONE ELECTRIC EQUIPMENT COMPANY showed Simplex electric heating goods, intercommunicating apparatus for commercial and home work and a line of motors.

JOSEPH THIEBEN & COMPANY, electric lamp dealers, displayed everything in the lamp line from searchlights to parlor chandeliers, including automobile lamps and batteries, tungsten and carbon lamps, etc.

The HOME TELEPHONE COMPANY had an interesting display of its automatic telephone system with apparatus in working operation. Two types of private branch exchanges were shown in service. The company had sixty telephones in operation in the various booths. Automatic switching devices were shown in glass display cases.

JOHN R. COLE COMPANY had a display of Hubbell specialities, American circular loom, Stanley & Patterson batteries, Matthews Brothers' specialties and oil circuit breakers.

GRAY NATIONAL TELAUTOGRAPH COMPANY showed its line of instruments for the reproduction of handwriting, pictures, etc.

The DRENDELL ELECTRIC COMPANY made a strictly "home industry" display of goods manufactured in San Francisco, including high-tension switches, panel boards, automatic switch and stage apparatus, remote control switches, etc. A three-panel, high-tension board for the Central Electric Company, of Fort Whipple, Ariz., and a three-panel low-tension board for the Cuayaga Rubber Company, of Mexico, were installed in the booth.

The DEAN ELECTRIC COMPANY showed a complete line of telephone supplies, switchboards, flash-light police and fire systems, harmonic converters, etc.

The ELECTRIC RAILWAY & MANUFACTURERS' SUPPLY COMPANY, "The Specialty House," Coast agents for the Ericsson and De-Veau telephone apparatus, showed a full line of these goods, as well as Trumbull switchboards—one of seven panels, 21 ft. long being installed.

The AMERICAN EVER READY COMPANY made a feature of its Ever Ready batteries, the only battery made on the Coast. The capacity of the company's plant is a carload of batteries a day. The company also had a very attractive display of Christmas lighting, and also showed its automatic engine starters and other automobile specialties.

The ELECTRIC STORAGE BATTERY COMPANY, through its agents, the Pierson-Roeding Company, had a generating set such as is installed for country-house lighting in connection with a large line of "Chloride" and "Exide" batteries.

The DIRECT LINE TELEPHONF COMPANY had on exhibit a model system with seven instruments in operation, showing the small desk pigeonhole telephones and demonstrating the convenience and advantages of the system.

D. H. BURRELL & COMPANY showed a Burrell-Lawrence-Kennedy electric milking machine and their exhibit proved most popular to the layman. Two Holstein cows were on duty and although they had never been milked by this device before they did not "kick," but gave milk to the edification and enjoyment of the public.

The ELECTRICAL CONTRACTORS' ASSOCIATION, of California, which includes in its membership practically all the electrical construction companies in the State, including forty in San Francisco, District No. 1, had a spacious booth which was maintained as headquarters for the members. Several of the members contributed exhibits which included an ingenious display of metal molding, condulet and knob and tube work arranged to form an electric sign.

The JUPITER SWITCHBOARD COMPANY had installed in the above space three types of panel boards, one of which, built of a large sheet of plate glass, with extremely simple and also practical switch and busbar connections, all in bright copper, made a very striking exhibit.

The AMERICAN FAUCET COMPANY, of San Francisco, showed in operation several of its "Little Giant" vacuum cleaners.

The PACIFIC ELECTRIC COMPANY had a very interesting exhibit of oil switches, including an electric control switch (oil) for 80,000 volts. The company also had set up complete on short poles a pole-top switch of the Baum type for high-tension work up to 100,000 volts.

The LEVY ELECTRIC COMPANY, of San Francisco, had a display of wireless telegraph goods, motors and washing-machines, vibrators, moving pictures showing the workings of the company's store, also photographs of the large jobs done by the firm. This company also had the contract for wiring the Coliseum.

The NATIONAL DICTOGRAPH COMPANY had one of the most popular exhibits. It showed its dictograph, affording communication without picking up the telephone. An instrument was also connected up with a downtown theater and the public was given an opportunity to hear the music and the actors.

CHARLES L. KIEWERT and the CROCKER-WHEELER COMPANY jointly occupied a space under the direction of the Engineering & Maintenance Company, San Francisco agents. A very interesting exhibit was shown of a variety of flaming and luminous arcs for a number of purposes, the types including the Siemens, Aurola, Alba, Triplex, Economy and Lilliput, while the well-known Crocker-Wheeler motors and generators were well represented.

The KELLOGG SWITCHBOARD & SUPPLY COMPANY exhibited a complete line of telephone apparatus, including a train dispatching telephone system, harmonic four-party line system, etc.

The STANDARD UNDERGROUND CABLE COMPANY showed its largest telephone cables and power transmission cables, Davis terminals, submarine cables and a lead press illustrating the method of placing lead on the cables.

OTIS & SQUIRES, manufacturers' agents, displayed a line of specialties as follows: Switchboard panel by Krantz Manufacturing Company, lineman's tools by Mathias Klein, conduit by American Conduit Company, instruments by Roller Smith Company, gas-engine coils and magnetos by Knoblock-Heideman Company, L. B. Allen soldering compound, Dossert & Company's solderless connectors, Van Nort carbon brushes, Paragon Seller telephones, drop "Ironite" wire, and Columbia incandescent lamps.

The CENTURY ELECTRIC COMPANY, of St. Louis, exhibited its line of motors and the California Incandescent Lamp Company made a display of Bryan-Marsh lamps.

The REED ELECTRIC WORKS had an interesting exhibit of its

electric welding machines, showing one machine in operation welding wire and other material.

The National Indian Rubber Company showed a line of wire and cables.

Kohler & Chase, of San Francisco, had a full line of electrical pianos, pianolas and electrical stringed instruments in operation for the enjoyment of the public. A large Wurlitzer auto band instrument was also exhibited by the firm and was used to supply the band music for the exposition.

The Brumfield Electric Sign Company, represented by Mr. W. C. Brumfield, the "original electric sign man" on the Pacific Coast, had a complete exhibit showing the automatic operation of electric signs.

The Pacific Telephone & Telegraph Company had a complete Bell telephone exhibit with eleven telephones for public use and two switchboards, one of which was in operation as a private branch exchange. During the evenings the company dispensed free music over its public instruments, which were provided with double receivers, the music being transmitted from Los Angeles, Seattle, Portland, Reno, Spokane and other Pacific Coast cities.

The Walters Surgical Company had a most complete line of X-ray and electro-medical apparatus, with static machines Crookes tubes of different sizes and colors, 10-in. spark machines, therapeutic lamps, etc.

The Studebaker Automobile Company showed four electric vehicles, a line of "Exide" batteries and a Westinghouse mercury rectifier.

The American Ironing Machine Company displayed household laundry machinery, including washers. ironers, collar machines, etc.

The Paraffine Paint Company had on exhibition its complete line of insulating pitch, tape, electrical compounds, paints, etc.

The San Francisco Municipal exhibit of the department of electricity, which was in charge of Mr. William H. Uring, chief of the department, was large and well planned. There was displayed the fire-alarm and police telegraph apparatus manufactured in the department's shops. An exact reproduction was installed of the fire-alarm system as well as the police telegraph, so arranged that the public could operate them and see the workings of the central-station instruments. The department has 348 miles of line in operation in the city.

The National Electric Lamp Association occupied four booths facing the two main aisles in the center of the Coliseum. Decorative arches, surmounting massive columns, surrounded the entire exhibit. Mazda lamps, fitted with the new "Stiletto" type Holophane reflectors, hung pendent from the arches. The supporting columns were surmounted by gold capitals and eagles of staffwork. A Spanish arbor was built in the center of the space for use as a reception room. The arbor was artistically decorated with autumn leaves and Oriental portières and lighted with Mazda lamps, giving a most attractive effect. The general decorative scheme was in white and gold. In addition to the regular line of Mazda lamps shown, there were displayed 110-volt and 220-volt tantalum and Mazda lamps, regular and round, the Mazda street series and sign lamps, the tantalum street-railway lamps and various sizes of Mazda miniature and automobile lamps. A complete outfit of automobile fixtures was exhibited, it being equipped with Mazda lamps lighted from a storage battery. An interesting historical feature of the exhibit was a number of Goebel lamps, which were used by Henry Goebel in New York in the early sixties. A Bunsen photometer illustrated the methods used in photometering incandescent lamps. A small rotating mirror photometer illustrated the distribution of light about a lighting unit and also emphasized the importance of using proper reflectors. Among those in attendance at the booth were Messrs. J. A. Vandegrift, L. S. Twomey and G. E. Norris, the exhibit being in charge of Mr. A. J. Hitzker, of the engineering department.

Mr. James Barker showed a line of electric vibrators, hair driers, etc.

The Sprague Electric Company and Fort Wayne Electric Works had a joint exhibit, the principal feature of which was a Fort Wayne electric drill in operation on a large block of sandstone. With a 1½-hp motor this machine, it is claimed, can drill anything that a 2½-in. air drill will bore and with one-eighth the power. They also showed a large line of power motors, wattmeters, etc.

The Duntley Pneumatic Cleaners, shown by the Compressed Air Cleaning Company, were centers of much interest, as were the electric water heaters, also exhibited in the same booth.

The Keller Manufacturing Company likewise showed its Keller-Santo vacuum cleaner, an exhibit machine being provided with a glass case in order to show the complete operation.

The Directograph, a device for electrically transmitting writing to a large display board, was the center of much interest to the public.

The General Acoustic Company showed its Acousticon, an electrical instrument for aid in hearing.

The Westinghouse Electric & Manufacturing Company, occupying 1000 ft. of space in the center of the hall, had a booth that was always the center of much interest. The industrial and power departments made features of motor-driven appliances, including vacuum cleaners, grinders, polishers, household and kitchen utensils, there being shown a complete line of every type of motor manufactured by the company. A miniature oil-well derrick with motors pumping, pulling and drilling oil wells was a feature. The details and supply department exhibited transformers, oil circuit-breakers, switches, heating appliances, toasters, etc. The lamp department showed on two revolving disks a great variety of lamps of all types and sizes. The publicity department was also well represented with its line of literature. As a novelty feature Mr. G. F. Haller operated electric signs with high-voltage and high-frequency current. He pereformed several novel electrical feats with a Tesla coil, Crookes tubes, Geisler tubes, etc. The exhibit was in charge of Mr. W. W. Briggs, manager of the San Francisco office, and was supervised by Mr. T. E. Collins. Others in attendance included Messrs. J. G. de Remer, C. E. Heise, L. A. Somers, J. J. Pottinger and W R. Dunbar.

The General Electric Company also occupied 1000 sq. ft. of floor space, the booth being divided into two sections. One was devoted to a complete line of energy-consuming devices of general interest and the other comprised a model electrical dining-room and kitchen completely equipped with cooking and heating devices. This exhibit was a very practical one and was in charge of competent demonstrators. In the general section were shown alternating-current and direct-current rectifiers and controlling apparatus, arc and incandescent lamps, instruments, switches, etc. A color booth was of special interest to merchants, the lamps including a full line of the Mazda and tantalum type. The exhibit was in charge of Mr. A. M. Hyler.

The *Electrical World* was represented by Mr. C. W. Whitney and Mr. George B. Burnham.

Mr. F. E. Smith had a full and very large line of Weston instruments, including those of the later types, such as power-factor meters, indicating and recording wattmeters, voltmeters, ammeters, etc. During the exposition a board was arranged with various instruments to measure the voltage, current and power consumption of the Coliseum and exhibits.

TELEPHONE TRAIN DISPATCHING EQUIPMENT FOR LOUISVILLE & NASHVILLE RAILROAD.

The Louisville & Nashville Railroad has placed an order for a complete equipment of Western Electric telephone train-dispatching apparatus including selectors and telephones. This equipment will cover the Cumberland Valley and Kentucky Divisions from Cincinnati to Norton, a distance of 304 miles, and will consist of six circuits in all, four train wires and two message crcuits, with a total of 162 stations.

The Louisville & Nashville already has installed a Western Electric train-dispatching telephone equipment, consisting of dispatcher's equipment and twenty-six way-station selectors, between New Orleans and Mobile, a distance of 139.7 miles.

Industrial and Commercial News

THE WEEK IN TRADE.

THERE were practically no changes in the condition of trade last week that were worthy of special mention. Continued good weather throughout the crop-producing sections has added somewhat to the general feeling of optimism, but has added little to the actual buying of retailers, or, in fact, to the buying of consumers. While it is universally admitted that all outside conditions are favorable and point to liberal business, there is still a widespread conservatism among all classes. While a few more mills may be employed than during the summer, all lines of both woolen and cotton manufactories are running at less than capacity. In the iron and steel industry it is estimated that the mills are not working at more than 50 per cent. of capacity. Some finished lines report a slightly larger volume of business being booked ahead, but the improvement is hardly important enough to boast about. Just at the present moment the railroads seem to be buying little and orders for structural material always fall off with the approach of winter. Among the electrical companies there has been a distinct slackening of business since the first of August. This is especially true with regard to the demand for heavy machinery. There is still considerable demand for telephone apparatus, and small motors are also selling in fair amount. Traction companies are also buying equipment in moderate volume and are keeping fairly busy the repair shops of some of the larger concerns. Considering the general state of demand in the iron and steel industry there has been a remarkably small amount of price cutting. It is reported that in a few lines of heavier materials a little price shading has been resorted to to stimulate orders, but in most important lines quotations have held firm. The early movement of the crops throughout the West and the high prices obtained have had the effect of making ready money rather plentiful, and have of course done a great deal to improve collections. Business failures for the week which ended Sept. 22, as reported by *Bradstreet's*, were 190, as compared with 210 the previous week, 171 in the same week of 1909, 267 in 1908, 166 in 1907 and 165 in 1906.

THE COPPER MARKET.

DEVELOPMENTS in the copper market last week were rather unfavorable to the holders of metal. There was more indication of pressure to sell and slight price concessions were made in many directions. Transactions, however, were very small, and inquiries for large lots of metal were so few that there is very little encouragement to expect much business in the immediate future. Domestic consumers are accepting shipments on former contracts without asking for postponement, but are placing very few new orders. It is expected that the report of the Copper Producers' Association for September will show large domestic deliveries, but this will not mean new business; they will represent the heavy orders taken in July and the early part of August. It is given out by many of the more optimistic selling agencies that the actual production of pig copper during the month of August shows considerable curtailment, and that the figures of the Copper Producers' Association represent refinery returns for the previous two months. If this is the system of preparing statistics, the August curtailment will not show in the copper tables until the October report is made public Nov. 8. Imports during the month of September have been relatively small when compared with earlier months of the year, but are still heavy enough to augment considerably the production figures. Exports for the month up to and including Sept. 26 have been 27,850 tons. Daily call on the metal exchange Sept. 26 quoted standard copper as per the accompanying table:

Standard Copper.	Bid.	Asked.	Settling price.
Spot	12.00	12.12½	.....
September	12.00	12.12½	12.07½
October	12.02½	12.12½	12.07½
November	12.02½	12.12½	12.07½
December	12.05	12.15	12.10

The London market Sept. 26 was as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	55 1 3	55 2 6
Standard copper, futures	55 15 0	55 16 3

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	13.50c	11.70c
London, spot	£62 0 0	£52 15 0
London, futures	65 18 9	53 7 6
London, best selected	65 10 0	57 15 0

INDUSTRIAL AND COMMERCIAL NOTES.

Central Colorado Power Company and Denver Gas & Electric.—It is now fairly well understood in Denver that the Central Colorado Power Company and the Denver Gas & Electric Company have come to terms and that a contract will soon be signed by which the Denver company will become the purchaser of practically all of the energy which the Central Colorado Power Company has for sale. In June there was a motion put on foot by the Central Colorado company looking toward securing a franchise from the city for distributing energy for lighting and power purposes. If such a program was ever seriously contemplated it has apparently been abandoned and wholesaling energy will be the entire business of the company. The Denver Gas & Electric Company, which is now entirely dependent upon steam plants, has agreed to purchase from the Central company about 10,000 hp per year, which practically is all that the company has for sale in Denver. In Denver there are many rumors that the Central Colorado Power Company intends to develop a number of new plants and increase its capacity to 50,000 hp, but these stories lack confirmation. For the past six weeks G. B. Walbridge, president, and O. B. Willcox, vice-president of the Central Power company, have been in New York negotiating the deal with the operating authorities of the Denver Gas & Electric Company. No official statement, however, is obtainable.

Telephone Improvement Company.—It is announced that Frederick C. Stevens, now chairman of the New York State Department of Public Works, will retire from this position at the end of the year to become president of the Telephone Improvement Company, a corporation soon to be incorporated under the laws of New York. This company will be formed through the consolidation of the Telechronometer Company, of Rochester, and the North Electric Company, of Cleveland. These companies control a patent meter for measuring the time-use of telephones, an automatic telephone message-meter and a new switchboard patent. The manufacturing plant of the new company will probably be in Rochester.

J. G. White & Company Contract.—J. G. White & Company, Inc., engineers and contractors, 43 Exchange Place, New York, have been awarded a contract by the New York, Ontario & Western Railway Company for the erection of railroad shops at their Mayfield yards, Mayfield, Pa., near Carbondale. The work to be carried out consists of the erection of a 10-stall roundhouse, with a 75-ft. turntable, machine shop, carpenter shop, with complete power plant, storehouse, office building, oil building, sand storage, drier and loading house, and a complete coaling station with a storage capacity of approximately 1,000 tons. The buildings will be of the usual type of brick and steel construction. The estimated cost is approximately $150,000.

Washington 300,000-hp Hydroelectric Development and 1200-mile Railway.—The Puget Sound, Chelan & Spokane Railway Company, a $25,000,000 corporation, with headquarters in London, New York and Tacoma, have secured the services of the W. K. Palmer Company, engineers, of Kansas City, in connection with the development of about 30 hydroelectric properties in the State of Washington aggregating 300,000 hp and the construction of 1,200 miles of railway to be operated from these plants. The Palmer Company will serve as consulting engineers, take charge of all engineering work and supervise construction.

Waverley Electric for Manchuria.—The Waverley Company, of Indianapolis, has recently sold through Fearon, Daniel & Company, of Shanghai, one of its electric runabouts to Taotai Key, managing director of the Mukden (Manchuria) Electric Light Works.

Sales of Ice-Making Machinery.—Within the last month the York Manufacturing Company, of York, Pa., has sold the following ice-making and refrigerating machinery: William Esser, Spokane, Wash., 11-ton refrigerating plant; Reading (Pa.) Abattoir Company, 65-ton compression side, brine coolers and piping; Consolidated Ice & Power Company, Valdosta, Ga., 11-ton refrigerating plant; Delaware Ice & Light Company, Selbyville, Del, 20-ton ice-making plant; George A. Fuller & Company, general contractors, 30-ton refrigerating plant for the Whitehall Annex Building, New York City; the Schumacher Company, Houston, Tex., eight-ton refrigerating plant; Great Falls (Mont.) Meat Company, 20-ton compression side and expansion piping; Charles F. Scheffer, Dewart, Pa., 10-ton refrigerating plant; Wilson Creamery Company, Huntington, W. Va., 40-ton compression side, brine coolers and piping; Percy Fur House, Oshkosh, Wis., six-ton refrigerating plant; Jacob A. Day, Kingston, N. Y., four-ton refrigerating plant; Henry Meyer, Brooklyn, N. Y., 240-ton complete ice-making plan; John Treber, Deadwood, S. D., eight-ton ice-making plant; McSweeney Packing Company, Sweetwater, Tex., 65-ton compression side, 10-ton freezing system and expansion piping; Althoff Manufacturing Company, Denver, Col., 30-ton compression side to be installed at the Western Packing Company's plant; Eastman Kodak Company, Rochester, N. Y., 400-ton high pressure side; Riverton (N. J.) Ice & Cold Storage Company, 20-ton compression side, 12-ton freezing system and brine piping, and Crystal Springs Ice Company, Cincinnati, 150-ton high pressure side.

Power, Transit & Light Company.—The Power, Transit & Light Company, of Bakersfield, Cal., has awarded a contract for the construction of a new steam power plant to J. G. White & Company, Inc., engineers and contractors, New York City. The building will be 82 ft. x 140 ft., with substructure of concrete, self-supporting steel frame, and walls of metal lath and plaster, which is the usual form of construction throughout lower California, and will be designed to accomodate two 2000-kw horizontal turbines, with boilers, condensers and necessary auxiliaries. A 750-kw turbine will be temporarily installed at the earliest possible date. Water for condensing purposes will be obtained from an irrigation ditch near the plant, and the water for boiler purposes will be supplied from wells to be driven near the power house. As the boilers will be installed with oil burners, there will be no basement under the boiler room. The station will be designed electrically to deliver practically full load at either 60,000 volts, 10,000 volts or 2300 volts, and will operate at all the above pressures simultaneously. The estimated cost is approximateyl $400,000.

Hickory (N. C.) Hydroelectric Plant.—Colonel Marcellus E. Thornton, of Hickory, N. C., has commenced construction of the hydroelectric plant on the Catawba River, three and one-half miles out from Hickory, of 9000 primary horse-power, with from 2000 to 8000 secondary horse-power, after over five years of indefatigable effort. The proposition is one believed to be of extraordinary merit. The dam is to be 42 feet high and the unpounded water extends back up to the Catawba River six miles, thus producing an area of impounded water the first two feet of which will alone operate the plant ten hours without other supply of water. Several large and strong concerns have bespoken current for power and will locate plants out on the river, where land is cheap and can be had, and in Hickory. An electric Edison storage-battery car line will be operated from the railroad at Hickory out to the dam at once. This will haul railroad cars and freight in bulk. The name of this corporation, which is under the laws of North Carolina, is the Water Power Electric Company. It will be completed and in operation within a year or fourteen months.

Power Plant for Comox (B. C.) Coal Fields.—Engineers are now at work making surveys in connection with the project of the Canadian Collieries (Dunsmuir) Limited, for the development of 50,000 hp on the Puntledge River in the center of the Comox coal field in British Columbia. The Canadian Colliers Company is controlled by Messrs. William McKenzie and D. D. Mann, who organized the company when they purchased the large coal interests of Hon. James Dunsmuir, ex-Premier and Governor of the Province of British Columbia, some months ago. It is expected that within the next month several hundred men will be employed on the construction of the dam and power house and that the whole work will be completed within a year. The electrical energy to be developed will be utilized in operating a system of compressed air haulage in the mines and in running the various plants, as well as a 14-mile railway line connecting the different collieries with the ore bunkers at Union Bay.

Allis-Chalmers Company.—The Allis-Chalmers Company reports that, while business continues to be good, orders during August were not as large as those in either July or June. A representative of the company says that domestic business showed a distinct falling off, except in the line of mining machinery. A few good orders for electrical apparatus were taken, among which might be mentioned a 6500-kw generator for the Cliff Electric Distributing Company, of Niagara; two steam turbines for the city of Grand Rapids; one 550-kva hydroelectric unit with transformers for Sturgis, Mich., and two 2000-kw steam turbine units for the New Jersey Zinc Company's plant at Hazard, Pa. There were also quite a number of large export orders for Russia, Japan and Mexico, principally devoted to mining machinery.

Electricity Helping the South.—B. Frank Mebane, a large cotton manufacturer of Spray, N. C., who has recently been in New York, is quoted as saying: "The situation of the cotton manufacturers in the South is growing better all the time. A large part of this improvement is due to the development of electric power for operating cotton mills. The extensive operations of the Southern Power Company mean the supply of power in small units to small plants and to individual consumers. This is a progressive step in the way of giving to the makers of cotton goods electricity to compete with the cheap manual labor of Japan and China. The use of electricity is the means by which our manufacturers can meet the competition of cheap foreign labor."

Amateur Wireless Operators Organizing.—An effort is being made under the direction of George Hiram Mann, an attorney of Washington, to form a national organization of amateur wireless operators. It is given out that the object of this organization is: first, to defeat the Depew bill; second, to secure the passage of the Roberts joint resolution, which provides a commission to take testimony before any legislative action is adopted, and, third, to secure an expression on behalf of all the amateurs favoring some positive legislation which will give them protection. This organization expects to be heard by any congressional committee that considers wireless legislation at the next session.

Mexican Interurban Lines.—The Mexico Tramways Company, the Canadian concern which owns the hydroelectric plant at Necaxa and the extensive system of electric railways in Mexico City, has received concessions from the Mexican government for the construction of two electric interurban lines. One is to run between Mexico City and Puebla, a distance of 129 miles, and the other between Mexico City and Toluca, 32 miles. The construction of these lines will involve some heavy and costly work. The concessions are for a period ninety-nine years, and construction work will be begun at once. It is expected to have both lines completed within three years.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable extensions to present plants at Comox, B. C., Can.; North Adams, Mass.; Bakersfield, Cal.; Georgetown, Cal.; San Marcos, Tex.; Sykesville, Md.; Yorkton, Sask., Can.; Alexandria Bay, N. Y.; Allentown; N. J.; Anaconda, Mont.; Rochester, N. Y.; Duluth, Minn.; Centreville, Mich., and Buffalo, N. Y.

Trent River Energy at $25 a Hp-year.—A Campbellford (Ont.) company which has acquired interests for the development of electricity at Healey's Falls on the Trent River, has made a proposition to supply the Kingston (Ont.) city corporation with electrical energy at $25 per hp per annum. If negotiations are concluded it is intended that construction of the power plant will commence and that energy may be delivered within a year.

General Electric Company Sales.—Among the recent sales of the General Electric Company are: two 1500-kw steam turbine units to the Cleveland Electric Illuminating Company, to be installed in the Seventieth Street power station, and one 1000-kw rotary converter to the Yonkers Railroad Company.

Charleston Consolidated Railway & Lighting Company.—The Charleston Consolidated Railway & Lighting Company has let a contract for the construction of its new power plant. The plant when completed, it is estimated, will cost about $200,000.

Financial.

THE WEEK IN WALL STREET.

THERE were a number of interesting happenings in the Wall Street market last week which tended to promote more than usual interest and to a limited degree some activity. While the total transactions for the week were not large, they were an improvement over the few weeks previous. The trend of prices was upward, but at the end of the week there had been some reactions and net gains were small. The first encouraging development was the decision of the master in the Minnesota Circuit Court of Appeals on the Northwestern rate case. This decision, which was in favor of the railroad, furnished much encouragement to Wall Street traders and produced some interest in railroad shares. It was immediately followed by a fair advance, which, however, only lasted two days, owing to sales by profit-takers and to the statement made by Commissioner Lane, of the Interstate Commerce Commission, to the effect that the railroads could not solve their financial difficulties by higher traffic charges. It was the general opinion that such a statement would not have been made by Mr. Lane had it not reflected the prevailing sentiment of the commission. Another feature which helped along Wall Street sentiment was the practical announcement of the entrance into the Interborough Rapid Transit Company of a powerful syndicate of bankers. One bright feature of the week was a somewhat better enquiry for bonds. Actual transactions in bonds were considerably increased and prices for all good issues were notably stronger. Although such a thing is unusual at this period of the year, there were substantial reductions made last week in the rates for time money. This indicates that the banks are still well supplied, and also that they are losing some of that conservatism which has been so marked within the past two months. Quotations Sept 26 were: Call, 1¾ @ 2 per cent; 90 days, 4½ @ 4¾ per cent. The quotations in the table are those of the close Sept. 26.

NEW YORK.

	Sept. 19.	Sept. 26.	Shares sold.		Sept. 19.	Sept. 26.	Shares sold.
All.-Ch.	8¼*	8¼*	——	Int.-Met., pfd.	54⅝	56¾	83,390
All. Ch., pfd.	30*	30*	——	Mackay Cos..	89⅝*	92½*	1,850
Amal Cop...	63⅜	62	88,555	Mackay C.,pf.	73⅝	73⅝*	300
Am. D. T....	20½*	20½*	——	Man. Elev...	134¼	138*	1,547
Am. Loc.....	37	37⅝	1,400	Met. St. Ry..	15*	15*	——
Am. Loc.,pfd.	106*	104½*	100	N.Y.&N.J.Tel.	139¼*	139¼*	——
Am. Tel. & C.	71¼*	71*	100	Steel, com...	67⅝	68¾	429,100
Am. T. & T..	135	137¾	8,270	Steel, pfd....	115½	116¼	2,905
B. R. T.....	74⅞	76⅝	16,400	W. U. T....	64½	68½	3,100
Gen. Elec....	142½	145	700	West'h, com.	60½	62½	3,600
Int.-Met.	20⅝	21½	70,550	West'h, pfd..	110*	125*	400

PHILADELPHIA.

	Sept. 19.	Sep. 26.		Sept. 19.	Sep. 26.
Am. Rys.....	43	43¼*	Phila. Elec.....	15⅝	15⅞
Elec Co. of A.....	11⅜*	11½*	Phila. R. T.....	17⅝	18⅛
Elec. St. B'ty.....	48⅜	47	Phila. Trac.....	81¾	81*
E. S. B'ty, pfd.....	30*	30*	Union Trac.....	42¾	43½

CHICAGO.

	Sept. 19.	Sep. 26.		Sept. 19.	Sep. 26.
Chi. City Ry.....	180*	180*	Chi. Tel Co.....	118½*	120*
Chi. Rs., Ser. 1.....	65*	61½	Met. El. Co.....	19*	19*
Chi. Rs., Ser. 2.....	13¾*	15⅞	Met. El., pfd.....	62*	60*
Com. Edison.....	111	112*	Nat'l Carbon.....	123	123*
Chi. Subways.....	4¾*	4½	Nat'l Car., pfd.....	120*	119½*

BOSTON.

	Sept. 19.	Sep. 26.		Sept. 19.	Sep. 26.
Am. T. & T.....	135	138⅜	Mex. Tel.....	5*	5¾*
Cum. Tel.....	144½*	143	Mex. Tel., pfd.....	6¼*	6½*
Edison E., Ill.....	256*	257½*	N. E. Tel.....	130	130
Gen. Elec.....	142½*	145	W. T. & T.....	15	15*
Mass. E. Ry.....	17¼*	18	W. T. & T., pfd.....	83*	83*
Mass. E. Ry., pfd...	81½*	81½			

*Last price quoted.
Shares sold for week Sept. 19 to Sept. 24.

FINANCIAL NOTES.

Montreal Power-Railway Merger.—The past week has seen another new record reached on the Stock Exchange for Montreal Light, Heat & Power Company, the stock going to over 161 during a week of considerable excitement, consequent upon the meeting on the same day of the boards of directors of the Montreal Street Railway and the Montreal Light, Heat & Power companies. It is understood that as a result of these meetings a circular will shortly be forwarded to the shareholders of the two companies suggesting a possible basis of amalgamation, current rumors being to the effect that Montreal Street Railway stock will be taken into the amalgamation at 250, while 190 will be the figure allowed to the shareholders of the power company. The proposed consolidation has aroused the citizens of Montreal, and it is proposed to have the board of control or City Council request the recently formed Public Utilities Commission to investigate the proposed merger. Colonel Hibbard, chairman of the commission, stated that according to the act constituting the commission, where the rates are not a matter of contract, the commission has the power to revise rates, and it may fix them at what it considers a reasonable figure.

Traction Opposition In Montgomery, Ala.—On Sept. 19 a street railway franchise was granted by the City Council of Montgomery, Ala., to Colonel Charles F. Woodward and associates of Boston, Mass. Colonel Woodward has put up cash forfeit to guarantee the building of a trolley road. It is expected that an extensive system will be developed, and that many of Montgomery's suburbs will be reached. It is claimed that since the lines of the Montgomery Traction Company were built the center of population of the city has considerably expanded. The new street railway with a few miles of track will reach the majority of the population. It is reported that this new street railway project has the backing of Henry L. Doherty and other New York financiers. The Doherty interests are already heavily involved in Montgomery, controlling the Montgomery Light & Water Power Company. Recently the interests back of this company attempted to take over the Citizens' Light, Heat & Power Company—the controlling interest of which is in the hands of R. Tillis, who owns the existing traction company.

Commonwealth Power, Railway & Light Company.—The make-up of the Commonwealth Power, Railway & Light Company, the holding concern of the Hodenpyl, Walbridge & Company and the E. W. Clark & Company properties in Michigan, is officially given out as follows: Constituent companies, Grand Rapids Railway Company, Saginaw-Bay City Railway Company, Michigan Light Company, Consumers' Power Company, and Cadillac Water & Light Company. The company owns and operates the street railway properties in Saginaw, Grand Rapids and Bay City and the interurban line connecting the two last-named cities; gas properties in Jackson, Kalamazoo, Pontiac, Flint, Saginaw and Bay City; electric light and power companies in Grand Rapids, Kalamazoo, Jackson, Flint, Saginaw, Bay City, Cadillac, Pontiac, Battle Creek, Lansing, and a number of intermediate cities and towns. The capital stock of the company is $6,000,000 cumulative 6 per cent preferred, $12,000,000 common stock. There have been no bonds issued.

Northwestern Elevated Railroad Company.—The annual report of the Northwestern Elevated Railroad Company of Chicago, for the year ended June 30, 1910, shows total earnings of $2,632,038, an increase of $91,155 compared with the preceding year. Operating expenses for the year amounted to $1,055,685, including $737,670 for conducting transportation, $149,593 for maintenance of equipment, $56,435 for maintenance of way and structure, and $111,987 for general expenses. The other charges against earnings amounted to $1,200,254, including bond interest of $944,100. The net earnings were $376,029, of which $150,000 was paid in dividends. The report shows that the ratio of operating expenses to earnings in the fiscal year 1910, exclusive of the earnings of the Union Loop, was 51.25 per cent, compared with 49.82 per cent for the preceding year.

Metropolitan West Side Elevated Railway Company.—For the year ended June 30, 1910, the Metropolitan West Side Elevated Railway Company of Chicago reports total earnings of $2,991,368, of which $2,862,932 was passenger earnings. The increase in gross revenue was 9.4 per cent over the preceding year. Total operating expenses amounted to $1,503,525, including $902,769 for conducting transportation, $214,902 for maintenance of equipment and $135,560 for maintenance of way. The total net income of the year was $1,500,091, a gain of over 13 per cent, compared with the preceding year. Bond interest, taxes and various charges consumed $1,075,868 and dividends on preferred stock $130,618, leaving $293,604 for surplus, which now stands at $1,676,581. The ratio of operating expenses to receipts was 40.26 per cent.

South Side Elevated Report.—The South Side Elevated Railroad Company, of Chicago, reports total gross earnings for the year ending June 30, 1910, of $2,348,000, an increase of about $130,000. After the payment of all fixed charges and deducting $50,000 for depreciation there remained available for dividends $249,000, or 2.42 per cent. on the $10,323,800 common stock of the company.

Westinghouse Back Dividends.—At a meeting of the directors of the Westinghouse Electric & Manufacturing Company last week the back dividends, amounting to 8¾ per cent on the preferred stock, were ordered paid. This will wipe out all of the arrears due on this stock which accumulated while the company was in the hands of the receiver. The first payment of these back dividends will be 3½ per cent, which will be paid Oct. 15; the next, 3½ per cent, will be paid Jan. 15, 1911, and the remainder, 1¾ per cent, paid April 15, 1911. The directors also declared the regular dividend of 1¾ per cent on the preferred stock, which is payable Oct. 15. These payments aggregate about $350,000, and the total dividend payments for the last six months will aggregate $420,000.

Pennsylvania Light and Power Merger.—There was recorded at Harrisburg last week a merger of the Philadelphia & Suburban Gas & Electric Company with the Pottstown Light, Heat & Power Company, North Penn Gas Light Company and the Lansdale & North Wales Gas Company. The combined capital of these companies is given as $4,457,500. The stocks of the four companies are owned by the American Gas Company, of Philadelphia, and the merger is in line with the plan to unite all of its subsidiary concerns. The officers of the new corporation, which will be called the Philadelphia & Suburban Gas & Electric Company, are: M. W. Stroud, of Villanova, president; S. P. Curtis, of Ardmore, vice-president; W. T. Robinson, of Haverford, secretary and treasurer.

Sedalia (Mo.) Light & Traction Company.—The bondholders' protective committee of the Sedalia Light & Traction Company, of which Otto T. Bannard, of New York, is chairman, announces that $320,000 par value of bonds have been deposited with the New York Trust Company, and $152,000 have been deposited in Chester, Pa., under an agreement to act in concert with the committee. The total issue of bonds is $749,000.

DIVIDENDS.

American Cities Railway & Light Company, preferred, quarterly, 1½ per cent, payable Oct. 1.

American Gas & Electric Company, quarterly, 1½ per cent, payable Oct. 1.

American Telephone & Telegraph Company, quarterly, 2 per cent, payable Oct. 15.

Bell Telephone Company of Canada, quarterly, 2 per cent, payable Oct. 15.

Capital Traction Company, Washington, quarterly, 1½ per cent, payable Oct. 1.

Carolina Power & Light Company, Raleigh, N. C., quarterly, preferred, 1½ per cent, payable Oct. 1.

Central & South American Telegraph Company, quarterly, 1½ per cent, payable Oct. 8.

Chattanooga Railway & Light Company, preferred, quarterly, 1¼ per cent, payable Oct. 1.

Chicago City Railway Company, quarterly, 2½ per cent, payable Sept. 30.

Cleveland Railway Company, quarterly, 1¼ per cent, payable Oct. 1.

Consolidated Gas, Electric Light & Power Company, Baltimore, preferred semi-annual, 3 per cent, payable Oct. 1; common semi-annual, 2 per cent, payable Nov. 1.

Detroit Edison Company, quarterly, 1½ per cent, payable Oct. 15.

Electric Storage Battery Company, quarterly, both preferred and common, 1 per cent, payable Oct. 1.

Gamewell Fire Alarm Company, quarterly, 1¾ per cent, payable Oct. 1.

Gary (Ind.) & Interurban Railway Company, quarterly, 1 per cent, payable Oct. 10.

Illinois Traction System, preferred, quarterly, 1½ per cent, payable Oct. 1.

Kansas Gas & Electric Company, Wichita, preferred, quarterly, 1¾ per cent, payable Oct. 1

Manchester Traction Light & Power Company, quarterly, 2 per cent, payable Oct. 15.

Mexican Telegraph Company, quarterly, 2½ per cent, payable Oct. 15.

Mexican Telephone & Telegraph Company, preferred, semi-annual, 2½ per cent, payable Nov. 1.

New England Telephone & Telegraph Company, quarterly, 1½ per cent, payable Sept. 30.

Pennsylvania Lighting Company, preferred, quarterly, 1¼ per cent, payable Oct. 15.

Terre Haute, Indianapolis & Eastern Traction Company, preferred, quarterly, 1¼ per cent, payable Oct. 1.

Tri-City Railway & Light Company, preferred, quarterly, 1½ per cent, payable Oct. 1.

Union Switch & Signal Company, preferred, quarterly, 3 per cent, common 3 per cent, both payable Oct. 10.

West India Electric Company, quarterly, 1¼ per cent, payable Oct. 1.

Westinghouse Air Brake Company, quarterly, 2½ per cent, extra 1½ per cent, special 1 per cent, all payable Oct. 10.

Westinghouse Electric & Manufacturing Company, quarterly, preferred, 1¾ per cent, payable Oct. 15.

REPORTS OF EARNINGS

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Light & Traction Company:					
August, 1910	$267,302	$11,516	$255,786	.....	.....
August, 1909	236,410	8,215	228,195	.....	.....
Boston Suburban Electric Company:					
August, 1910	107,791	.....	43,300	.....	$28,401
August, 1909	111,521	.....	43,055	.....	29,162
Central & South American Telegraph Company:					
Quarter ended Sept. 30, 1910	408,000	173,000	238,200	$143,565	94,635
Quarter ended Sept. 30, 1909	371,000	163,000	210,200	143,565	66,637
Chicago South Side Elevated Company:					
Year ended June 30, 1910	2,348,135	1,595,170	752,965	360,000	392,965
Year ended June 30, 1909	1,429,578	1,546,018	683,560	.....	69,405
Kansas City Railway & Light Company:					
August, 1910	621,929	367,760	254,169	188,460	65,709
August, 1909	652,747	392,441	260,306	174,033	86,273
Mexican Light & Power Company:					
August, 1910	583,338	.....	439,811	.....	.....
August, 1909	482,888	.....	197,403	.....	.....
Mexican Telegraph Company:					
Quarter ended Sept. 30, 1910 (estimated)	187,500	42,000	171,000	.....	161,500
Quarter ended Sept. 30, 1909	157,000	38,000	144,500	.....	137,000
Mexican Tramways Company:					
August, 1910	526,001	259,270	266,731	.....	.....
August, 1909	469,473	232,008	237,463	.....	.....
Montreal Street Railway Company:					
August, 1910	396,828	216,314	182,514	69,891	112,624
August, 1909	355,229	190,582	174,647	62,026	112,620
Nashville Railway & Light Company:					
August, 1910	146,038	87,748	58,290	37,758	20,531
August, 1909	138,194	83,522	54,672	37,162	17,507
Northern Ohio Traction & Light Company:					
August, 1910	263,149	135,832	127,316	43,495	83,821
August, 1909	231,061	115,724	115,336	43,287	71,633
Northwestern Elevated Railroad Company, Chicago:					
Year ended June 30, 1910	2,632,039	1,055,686	1,576,353	1,200,254	376,098
Year ended June 30, 1909	2,540,883	995,818	1,545,064	1,189,288	355,776
Ontario Power Company:					
August, 1910	62,660	12,191	50,469	50,160	7,560
August, 1909	48,899	11,750	37,149	27,146	630
Philadelphia Rapid Transit Company:					
Year ended June 30, 1910	17,991,100	9,886,759	8,104,342	8,374,463	1,329,723
Year ended June 30, 1909	18,317,529	9,364,737	8,952,792	8,192,572	224,279
Third Avenue Railroad System:					
Year ended June 30, 1910	6,570,085	4,250,759	2,319,325	1,302,332	1,768,804
Year ended June 30, 1909	6,085,449	4,150,981	1,934,468	1,119,023	1,411,501
Westinghouse Air Brake Company:					
Year ended July 31, 1910	.....	.....	4,653,102	429,824	4,223,278
Year ended July 31, 1909	.....	.....	2,039,273	118,716	1,920,557

General News

Construction News.

BIRMINGHAM, ALA.—The City Council is contemplating enlarging the electric light plant in North Birmingham, recently taken over by the city.

BIRMINGHAM, ALA.—At an election held Sept. 19 the citizens voted against the proposition to sell the municipal electric light and water plants in North Birmingham.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company has ordered special tungsten lamps which will be placed in one of the principal alleys of the city as an experiment. If satisfactory it is expected that all downtown alleys will soon be lighted by tungsten lamps.

MONTGOMERY, ALA.—The City Council has granted the Montgomery Traction Company a franchise to extend its road from the end of the present Cloversdale line to the new college for women, in Montgomery.

NORMAL, ALA.—Walter S. Buchanan, it is reported, would like to receive prices on electrical equipment for lighting hospital and trades school.

BENSON, ARIZ.—The installation of an electric light plant in Benson is under consideration. The equipment of the plant will include a 60-kw generator and two engines. J. E. Collins, of Tucson, Ariz., is interested in the project.

JEROME, ARIZ.—The Haynes Copper Company is reported to be installing electrical euipment for operating machinery at its mines, including a large motor-driven pump. The company contemplates extensive development work, which, it is said, will require additional equipment in the spring.

PHOENIX, ARIZ.—Extensive improvements and extensions are contemplated by the Phoenix Railway Company to its local and interurban lines, which will involve an expenditure of about $125,000. The work will include the construction of a ten-mile extension to the Indian School and to Glendale, laying new tracks on other lines and the purchase of new rolling stock. Samuel L. Mitchell is general manager.

FORREST CITY, ARK.—The Caldwell Telephone Company is reported to be constructing rural lines in St. Francis County, from Forrest City to Good Hope.

GRAVETTE, ARK.—The local electric light plant, owned by the Electrical Promoting Company, is reported to have been purchased by the City of Gravette, and will be operated as a municipal plant. It is proposed to enlarge and improve the entire system. A new generator has already been purchased. E. F. Craven has been engaged as superintendent.

LITTLE ROCK, ARK.—Contracts will soon be awarded by the Little Rock & Hot Springs Electric Railway Company for the construction of its proposed railway from Little Rock to Hot Springs. L. Garrett, 219½ Main Street, Little Rock, Ark., is general manager.

ALHAMBRA, CAL.—At a meeting of the taxpayers, held recently, the proposition to install a municipal electric light plant was carried. Bonds will be voted to provide funds to establish a plant.

BAKERSFIELD, CAL.—The Power, Transit & Light Company, of Bakersfield, Cal., has awarded the contract for the construction of a steam and electric power plant in Bakersfield, to J. G. White & Company, engineers, 43 Exchange Place, New York, N. Y. The building will be 82 ft. x 140 ft. and will be designed to accommodate two 2000-kw, horizontal turbines, with boilers, condensers and auxiliary apparatus. A 750-kw turbine will be installed as soon as possible. The boilers will be installed with oil burners. The station will be designed to deliver electricity at either 60,000, 10,000 or 2300 volts, and will operate at all the above pressures simultaneously. The cost of the plant is estimated at $400,000.

BARSTOW, CAL.—Sealed bids will be received by the Board of County Supervisors until Oct. 10 for a franchise applied for by the Pacific Light & Power Company to erect and maintain lines for the transmission and distribution of electricity upon highways of this county.

BARSTOW, CAL.—The Atchison, Topeka & Santa Fe system is reported to have added $75,000 for the installation of an electric light plant to its appropriation of $500,000 for expenditures in the Town of Barstow, where extensive improvements are being made in connection with its system. The equipment of plant includes two 100-kw General Electric turbo-generator sets.

FRESNO, CAL.—The San Joaquin Power Company has secured several contracts to supply electricity from its new Crane Valley power plant to the gold mines in that vicinity. The company is erecting new transmission lines to Merced, which will soon be completed. A new line is also being erected up Merced River to Jaspar to the large rock crushing plant in that place; it is also proposed to build a line to the Yosemite Stone Company's plant, located on the Merced River, eight miles above Merced Falls. Transmission lines are also being extended to Snelling to supply energy for lamps and motors in that town and also to a gold dredging plant located near there. It is also proposed to extend the system to the Mount Gains Mine. A. G. Wishon is general manager.

GEORGETOWN, CAL.—Preliminary work is now being done by the Rubicorn Water & Power Company for the construction of a large hydroelectric power plant on the American River, above Georgetown. The company maintains an office in Georgetown, Cal.

GEORGETOWN, CAL.—Preparations are being made by the Loon Lake Water & Power Company, successor to the California Water & Mining Company, for the construction of large storage reservoirs and erection of large hydroelectric power plants on the Georgetown Divide. It will require several years to complete the work. A large part of the work is located about 25 miles from Georgetown. H. D. Jerrett is local manager.

LOS ANGELES, CAL.—The Pacific Electric Railroad Company has applied to the City Council for a franchise to lay tracks in Pedro Street.

LOS ANGELES, CAL.—The Southern California Edison Company, of Los Angeles, has secured, through a subsidiary company, the Chuckawalla Power Company's rights on the Colorado River, thus furnishing it with the key to a situation which means the beginning of a large irrigation project in the Southwest. The country to be reclaimed is tributary to Parker, Ariz. It is estimated that 500,000 acres can be ultimately reclaimed, of which 250,000 acres are on the California side of the Colorado River, in the great Chuckawalla Valley. The company proposes to construct a dam of solid masonry 60 ft. high and 900 ft. long across the Colorado River, six miles above Parker.

PLACERVILLE, CAL.—The American River Electric Company has recently installed three 1500-kw oil-insulated water-cooled transformers in its plant on the American River, located about seven miles from this city. Automatic high-tension circuit breakers will be instituted.

TRINITY CENTER, CAL.—Work has commenced on the construction of a new power plant to replace the one destroyed by fire nearly two years ago. It is expected to have the plant completed so that work in the mines can be resumed before winter.

UPLAND, CAL.—The City Council has passed an ordinance granting a franchise to the Pacific Light & Power Company to erect transmission lines on Orange Avenue in Upland and to connect with the Tenth Street line. The company, it is said, will probably erect a power house on Orange Avenue.

WHITTIER, CAL.—The Southern California Edison Company is contemplating the extension of its transmission lines to East Whittier to supply electricity for lamps and motors to the various oil fields in that vicinity.

DENVER, COL.—It is reported that negotiations are under way between the Central Colorado Power Company and the Denver Gas & Electric Company, whereby the latter company will retail all of the energy supplied by the Central Company in Denver. It is also stated that the Central Colorado Power Company is contemplating the construction of another power plant to be located at Grizzley Creek, six miles east of Glenwood Springs, in the cañon of the Grand River. The plans include driving a two-mile tunnel below the present bore and increasing the output of the company from 26,000 to 50,000 hp.

MONTROSE, COL.—A company has been organized to construct an electric railway through sections of the Uncompahgre Valley in Delta County. The proposed railway will connect Montrose, Olathe, Delta, Hotchkiss and Paonia. Electricity for operating the road will be secured from a plant at one of the drops in the Gunnison tunnel irrigating project, providing satisfactory arrangements can be made with the federal government. T. P. Townsend, of Denver, Col., is president of the company. E. L. Osborn, cashier of the First National Bank, of Montrose, is also interested in the project.

NEW HAVEN, CONN.—It is reported that plans have been prepared by Westinghouse, Church, Kerr & Company, of New York, N. Y., for the construction of a new power house, 70 ft. x 135 ft., for the Winchester Repeating Arms Company.

SEAFORD, DEL.—It is reported that the construction of an electric light plant in Seaford for the purpose of supplying electricity in Seaford and other Sussex County towns is under consideration. It is not expected that active work will begin until after the expiration of the contract with the Sussex Light & Power Company, which now furnishes electricity in this place.

WASHINGTON, D. C.—Bids will be received at the office of the chief signal officer, War Department, Washington, D. C., until Oct. 3, for furnishing, under proposal No. 479, bluestone terminal boxes, battery renewals, conduit, safety strape, tool belts, sounders, tubes, voltmeters, clamps, insulators, relays, zincs, etc. Captain A. S. Cowan is disbursing officer.

WASHINGTON, D. C.—Bids will be received until Oct. 4 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the U. S. naval stations the following supplies: Brooklyn, N. Y., schedule 2911, 37,000 ft. of duplex rubber-covered wire; schedule 2918, mild steel plates, seamless drawn copper tubing. Bids will also be received until Oct. 11 as follows: Mare Island, Cal.—Schedule 2886, one motor-driven blower; schedule 2902, 3165 lb. weather-proof copper wire, 8500 ft. rubber-covered and braided copper wire and electrical supplies. Charleston, S. C.—Schedule 2930, one motor-driven engine lathe. Application for proposals should designate the schedule desired by number.

ELBERTON, GA.—Plans have been perfected for the installation of an ornamental illuminating system in the business section of the town.

LEWISTON, IDAHO.—The Interstate Telephone Company has submitted a proposition to the Commercial Club to extend its telephone line to Lewiston from a point near Spokane, Wash., to connect with the Nez Perce Co-operative Company, thereby securing connection to all sections in Nez Perce and Idaho counties. The cost of the proposed extensions is estimated at about $100,000.

BELLEVILLE, ILL.—The contract for lighting the streets, public grounds and buildings has been awarded to the St. Clair County Gas & Electric Company for a period of ten years. Under the terms of the contract the company is to supply 351 arc lamps at $24,570 per year. The municipal buildings are to be lighted free of charge.

CHICAGO, ILL.—The Victor Electric Company, of Chicago, Ill., it is stated, has increased its capital stock from $16,100 to $310,000. The company is planning to erect a large factory building, which will more than double the space now occupied by the company.

CHICAGO, ILL.—It is reported that plans are being prepared by F. E. Davidson, architect, 98 Jackson Boulevard, and Paterson & Davidson, engineers, 9 Jackson Boulevard, Chicago, Ill., for a power house for the Progress Company, to be erected at East Ravensford Park and Berteau Avenue.

ELGIN, ILL.—The International Voting Machine Company, of Elgin, Ill., is reported to be preparing plans for the construction of a factory building, 55 ft. x 145 ft., which will be equipped for electrical operation. It is understood that equipment for the plant has been purchased.

GENOA, ILL.—Application has been made to the Board of Trustees by the Woodstock & Sycamore Traction Company, of Woodstock, Ill., for a franchise to construct an electric railway in Genoa.

ROCKFORD, ILL.—The Paris Traction Company, of Paris, Ill., has petitioned the City Council for a fifty-year franchise to extend its railway as far as Chrisman.

ROCKFORD, ILL.—The Rockford Tool Company expects to have its new factory completed and ready for operation in a short time. The plant will be operated by electric motors. The equipment has already been purchased.

ANGOLA, IND.—The Angola Railway & Power Company has just completed the installation of a new Fort Wayne arc machine and forty-four Fort Wayne 4-amp. magnetite arc lamps. C. W. Morse is manager.

BRISTOL, IND.—The construction of an electric railway to connect Bristol, Mottville, Constantine, Battle Creek and Kalamazoo is under consideration. The proposed railway will connect with the Northern Indiana Railway at Bristol. Herbert E. Bucklin is interested in the project.

CONNERSVILLE, IND.—Contracts have been awarded for electrical equipment in connection with the new pumping station as follows: For furnishing vertical electric motors and turbo-generator condenser, to the General Electric Company, of Schenectady, N. Y., at $7,090; for furnishing electrical centrifugal unit for booster station, to the Cooper-Hewitt Company, of Louisville, Ky., for $572; for tubular boilers, etc., to the Browne Company, of Dayton, Ohio, for $838, and for deep well pumps to the Roth Manufacturing Company, of Indianapolis, Ind., for $2,125.

CRAWFORDSVILLE, IND.—Contracts have been awarded by the building committee of the municipal electric light plant as follows: For construction of chimney to M. W. Kellogg Stack Company, of Chicago, Ill., at $3,600; for heater and purifier, to the Hoppes Manufacturing Company, of Springfield, Ohio, $935. W. C. Carr & Son, of Crawfordsville, Ind., submitted the lowest bid for construction of the building. The contract for the building has not yet been awarded.

HARTFORD CITY, IND.—The Hartford City Lighting Company has applied to the Commissioners of Blackford and Jay counties for a twenty-five-year franchise to erect transmission lines and construct conduits for the transmission of electricity on the county roads. The company proposes to extend its system to Dunkirk and Redkey.

MACEY, IND.—The plant and holdings of the Macey Telephone Company have been purchased by Claude Warner and A. O. Yeareck, of Argus. The new owners are planning to remodel and extend the system.

LOGAN, IA.—It is reported that the Bullock Public Service Company has an offer of $6,000 for the local electric light plant.

GLASGOW, KY.—It is reported that the Louisville, Lincoln Farm & Mammoth Cave Junction Company has completed financial arrangements for the construction of its proposed railway, which is to connect Louisville and Mammoth Cave. The railway will be sixty miles in length. Work will commence on the project within ninety days. J. M. Richardson is president.

LEXINGTON, KY.—It is reported that the Lexington & Eastern Railway Company is contemplating the construction of a telephone line from Lexington to Jackson.

LOUISVILLE, KY.—The J. M. Robinson-Norton Company, of Louisville, Ky., is reported to be considering the construction of a new power house.

AMESVILLE, LA.—We are informed that Penick & Ford, Ltd., are in the market for a second-hand directly connected direct-current generating unit, 60 or 75 kw, 250 volt.

OWENSBORO, KY.—The City Council has granted the Owensboro & Rockport Bridge & Terminal Company a franchise to construct and operate a railway along the entire river front of Owensboro. The company is planning to build an electric railway from Rockport, Ind., to Owensboro, Ky., work on which will begin in the near future.

NEW ORLEANS, LA.—It is reported that the American Chicle Company is preparing to construct a new three-story factory building, 100 x 100 ft., and power plant, 25 ft. x 80 ft., in New Orleans, La., during the late fall or early winter.

BRUNSWICK, MAINE.—The selectmen have entered into a new contract with the Brunswick Electric Light & Power Company for street lighting, which provides for the removal of all but thirty-six of the arc lamps now in use and the installation of 105 tungsten lamps.

BALTIMORE, MD.—The Public Service Commission has approved the franchise of the Susquehanna Transmission Company to erect poles, wires and conduits in Baltimore County for the purpose of transmitting electricity from the Susquehanna River to Baltimore.

BALTIMORE, MD.—The Pennsylvania Railroad Company is reported to have awarded the contract for the construction of a new power plant, locomotive and car repair shop at Orangeville, Md., in connection with its improvements at Baltimore to Irwin & Leighton, of Baltimore.

BALTIMORE, MD.—The Susquehanna Transmission Company has applied to the Highways Commission to cross seventeen county roads with its transmission line, which the company proposes to erect from the Hartford County line through Baltimore County to the City of Baltimore.

BALTIMORE, MD.—It is reported that the Pennsylvania Water & Power Company has notified Superintendent of Lamps and Lighting McCuen that the company will not be able to supply the city with electricity. Mr. McCuen has been considering a plan under which it might be possible for the city to reduce the cost of street lighting. The plan contemplated the city owning the equipment and purchasing energy to operate the same.

BALTIMORE, MD.—Sealed proposals will be received until Oct. 5 by the Board of Awards, Baltimore, Md., for furnishing electric cable, transformers and switchboards to the various parks in the city of Baltimore, in accordance with specifications of the Board of Park Commissioners, which can be obtained at the office of the board, Madison Avenue entrance to Druid Hill Park, Baltimore, Md. William S. Manning is general superintendent of Board of Park Commissioners and J. Barry Mahool is president of Board of Awards.

SYKESVILLE, MD.—The board of directors of the Springfield State Hospital for the Insane has engaged Henry Adams to prepare plans for a new central power house and heating plant to be erected at the institution at Sykesville at a cost of about $75,000.

FALL RIVER, MASS.—The Aldermanic committee on street lamps has voted to recommend the substitution of gas and electric lamps for the 400 oil lamps now in use in the suburbs of the city; also to recommend the Mayor to execute a contract with the Fall River Electric Light Company for a term of five years to furnish not less than 100 incandescent electric lamps of 60 cp, the cost not to exceed $25 each per year, and to contract with the Fall River Gas Company for a term of three years to furnish and maintain 415 gas lamps of not less than 60 cp, the price not to exceed $22 each per year.

FOXBORO, MASS.—The Norfolk & Bristol Electric Light Company has applied to the Board of Gas and Electric Light Commissioners for permission to issue $300,000 in capital stock, the proceeds to be used for the purchase of a gas-generating plant in the Town of Foxboro. The company proposes to supply electricity and gas in this town.

NORTH ADAMS, MASS.—Plans are being considered for equipping the Hoosac Tunnel for electrical operation as soon as possible. It is understood that work will commence very soon on the construction of a power plant in Zylonite, to supply electricity for the tunnel. The equipment of the plant will include two 3500-kw generators.

NORTHBORO, MASS.—The Woodside Woolen Mills, of Northboro, Mass., have discarded steam power and are operating the mill by electricity supplied by the Marlboro Electric Light Company.

ORANGE, MASS.—Plans are being considered by the New Home Sewing Machine Company to remodel one of its buildings, which will be used in connection with the box making department. The machinery will be equipped for electric motor drive.

PITTSFIELD, MASS.—The Berkshire Street Railway Company is reported to have awarded the contract for the construction of a twenty-mile extension to the Woronoco Contracting Company. Surveys are now being made between Huntington and Lee.

SPRINGFIELD, MASS.—The United Electric Light Company has petitioned the State Board of Gas and Electric Light Commissioners for permission to issue additional capital stock to the amount of $250,000, the proceeds to be used for paying the cost of permanent additions and improvements to its plant.

ANN ARBOR, MICH.—The Eastern Michigan Edison Company has recently purchased the Hudson and Dover mill dams near the source of the Huron River, just below Portage Lake, including flowage rights, from the Birkett Manufacturing Company. The deed gives the Edison company the right to create a reservoir over two miles in length, extending to and connecting with Portage Lake.

BAY CITY, MICH.—The Tittabawassee Power Company, recently organized to supply electricity in Bay City, Saginaw and other towns has awarded a contract for the construction of a dam near Sanford, where 1800 kw will be developed.

CENTREVILLE, MICH.—The Centreville Water & Electric Company is making preparations to remodel its plant and install new equipment at a cost of about $15,000. F. W. Thomson is manager of the company and Vance I. Gray, 226 Huron Street, Toledo, Ohio, is engineer.

CHEBOYGAN, MICH.—W. H. Blake is reported to have disposed of the controlling interest in the Cheboygan Telephone Company. The new owners, it is said, contemplate making improvements to the system, including the installation of new equipment.

DETROIT, MICH.—Plans are being prepared by the Detroit Sulphite Fiber & Paper Company, of Detroit, Mich., for a large addition to its plant, which will be equipped for electrical operation throughout. Albert Danielson, of Kalamazoo, Mich., is engineer in charge of the work.

ESCANABA, MICH.—The Escanaba Traction Company, it is reported, is planning to commence preliminary work in connection with the construction of its proposed hydroelectric power plant. The company, it is said, will purchase some equipment and materials for the plant this fall.

GRAND RAPIDS, MICH.—Preparations are being made by the Imperial Furniture Company for the erection of a new plant in Grand Rapids, Mich. The plant will be equipped for electric-motor drive.

GRAND RAPIDS, MICH.—Two petitions have been presented to the City Council, signed by business men and property owners, asking that the question of granting a franchise to the Grand Rapids Power Company be submitted to the voters in November. The reason given for requesting the resubmission is the desire to secure flood protection by the elimination of the water-power canals and the establishment of a central power station at the dam.

ALEXANDRIA, MINN.—The City Council is reported to have awarded a contract to A. L. Ide & Sons, of Chicago, Ill., for the installation of an 85-hp engine and 50-kw generator, direct-connected, in the municipal electric plant, for $4,300.

CANBY, MINN.—Proposals will be received at the office of the City Recorder, Canby, Minn., until Nov. 3, for one 15-kw alternating-current generator, switchboard, one 7½-hp motor, wire, etc., for use in connection with operating a sewage pump. John S. Dodds is city engineer.

DULUTH, MINN.—Preparations are being made by the National Power & Development Company, Torrey Building, Duluth, Minn., for the development of a 1000-hp hydroelectric power project on Poplar River, about ninety miles from Duluth. The cost of the work is estimated at $170,000 and will include the construction of a 35-ft. reinforced concrete dam, 1200 ft. of conduit and a 30-ton paper mill. The power plant will supply electricity to operate the paper mill and also to operate a railway. D. A. Reed is consulting engineer and J. P. Rossman manager.

MINNEAPOLIS, MINN.—The Minneapolis Furniture Frame Company is reported to be contemplating the erection of a new three-story building, to be equipped for electric-motor drive.

OSYKA, MISS.—We are informed that bids will be asked about Nov. 1 by the city of Osyka, Miss., for the construction of an electric light plant and water works system, for which bonds to the amount of $20,000 were recently voted. Clinton Thompson is Mayor and Xavier A. Kramer, of Magnolia, Miss., is consulting engineer.

KANSAS CITY, MO.—The lighting committee of the City Council is negotiating with the officials of the Kansas City Electric Light Company to secure a reduction in the price of tungsten lamps now used in the business district furnished by the company. If satisfactory terms can be made it is proposed to install a uniform lighting system in the entire business district. The company now charges $32.50 per lamp per year and the committee has asked for a reduction to $20 each per year. Louis H. Egan is general manager of the company.

ST. JOSEPH, MO.—It is reported that the Home Telephone Company and the Postal Telegraph Company will build a joint telephone and telegraph line from St. Joseph to Hannibal, Mo. The proposed line will be about 200 miles in length and will cost about $140,000.

ST. LOUIS, MO.—Sealed proposals will be received by Maxime Reber, president of the Board of Public Works, until Oct. 7, for furnishing and erecting at the high-service station No. 2 one 30-ton electric traveling crane, complete with all appurtenances, as per letting No. 9991, and for furnishing and erecting complete at the high-service station No. 2 a steel crane runway and columns with all necessary connections, as per letting No. 10,147. Plans, specifications and forms of contract may be obtained upon application at the office of the Water Commissioner, room 312, new City Hall, St. Louis, Mo.

ANACONDA, MONT.—The Anaconda Copper Mining Company, it is understood, will require a large line of electric-motor driven machinery for its various properties in the vicinity of Anaconda.

HASTINGS, NEB.—The Hastings Telephone Company is reported to have received permission from the Railroad Commission to issue $110,600 in capital stock, making a total issue of $150,000.

KEARNEY, NEB.—The Railroad Commission is reported to have granted the Kearney Telephone Company permission to increase its capital stock by $11,225.

ALLENTOWN, N. J.—Bids will be received by Charles S. Joiner, borough clerk, until Oct. 19, for construction of a municipal electric light plant, furnishing and installing one 25-kw, direct-current, 3-wire, 250-volt generator; one 30-hp, internal combustion engine, one 15-ampere, 8-hour storage battery; 2½ miles transmission lines, street lamps, switchboard, etc. Plans and specifications and form of contract may be seen at the office of the borough clerk, Allentown, and at the office of W. W. Young, consulting engineer, 220 Broadway, New York, N. Y.; 46 Park Street, Bordentown, N. J., and 1002 Drexel Building, Philadelphia, Pa. A. Robinson is Mayor.

BLOOMFIELD, N. J.—It is reported that alterations are being made to the plant of the Scott & Bowne Company in Bloomfield, N. J., which will include the erection of a new boiler and engine house.

JERSEY CITY, N. J.—Plans have been prepared by L. O. Koven & Brothers for the construction of a power plant to be erected adjoining their plant on the Paterson Plank Road. The building will be 50 ft. x 75 ft., of brick and steel construction and will cost about $25,000.

MADISON, N. J.—The Borough Council is considering the question of making improvements to the municipal electric light plant, including the installation of three 2-phase, 60-cycle alternators, 250-kw, 120-kw and 70-kw, respectively, and new switchboard to control same. H. S. Torrey is chief engineer.

MOGOLLON, N. M.—The new hydroelectric power plant of the Helen Mining Company is reported to be nearly completed. Electricity generated at the plant will be utilized to operate the machinery, etc., in its mines.

ALEXANDRIA BAY, N. Y.—The St. Lawrence International Electric Railroad & Land Company expects to purchase during the next two months one 400-hp Corliss engine and one 200-kw General Electric generator to increase the output of the plant to meet the demands for electricity for lighting purposes. B. M. Martin, of Alexandria Bay, N. Y., is superintendent.

AVON, N. Y.—The Avon Electric Company has petitioned the Public Service Commission, Second District, for permission to extend its transmission lines from Lakeville to Geneseo, or from Long Point on Lake Conesus to Geneseo. The cost of the proposed extension is estimated at $1,350 per mile.

BUFFALO, N. Y.—The Cataract Power & Conduit Company has applied to the Public Service Commission, Second District, for permission to issue $178,000 in bonds, the proceeds to be used as follows: For overhead construction, $7,223; for cables, etc., $48,548; for conduits, $6,277; for transformers, $3,000; for meters, $5,500; for station equipment, $50,000.

DOLGEVILLE, N. Y.—The contract for lighting the streets of the village has been awarded to the Utica Gas & Electric Company, of Utica, for a period of five years, beginning Jan. 1, 1911. Under the terms of the contract the company is to supply incandescent electric lamps at $22.50 each per year and arc lamps at $75 per lamp per year, which is a reduction of $10 per year on price of arc lamps paid under the present contract.

MAYVILLE, N. Y.—The Mayville Telephone Company is reported to have increased its capital stock from $15,000 to $25,000.

PERRYSBURG, N. Y.—Sealed proposals will be received at the office of the Department of Public Works, room 1, City Hall, Buffalo, N. Y., until Oct. 8, for the construction of the J. N. Adam Memorial Hospital for Incipient Tuberculosis at Perrysburg, N. Y., including power house for same. Plans and specifications can be seen and printed forms of proposals secured on application at the Bureau of Buildings, the office of the architect, room 298, Ellicott Square, Buffalo, N. Y., and at the office of the trustees of the hospitals, room 411 White Building, Buffalo, N. Y. Francis G. Ward is commissioner of public works.

ROCHESTER, N. Y.—Extensive improvements and additions are being made to the plant of the Eastman Kodak Company, at Kodak Park, Rochester, N. Y., including the installation of a 1000-kw power plant, for which, it is understood, the company is now receiving bids for equipment.

SCHENECTADY, N. Y.—The Schenectady Railway Company is contemplating extending its system in Schenectady. A franchise will soon be applied for.

ASHEBORO, N. C.—Surveys are now being made for the proposed route of the transmission lines of the Southern Power Company from High Point to Asheboro, via Randleman, where the company has contracts to supply electricity for textile and woodworking plants.

CHARLOTTE, N. C.—Plans are being considered by the Southern Bell Telephone Company for extensive additions to its local system, for which an appropriation of $40,000 has been made. The work will include an addition to the exchange building and extension to the underground system.

CHARLOTTE, N. C.—The Piedmont Traction Company, which is constructing an interurban electric railway between Mt. Holly and Charlotte, is reported to have awarded contracts for the equipment of the entire system. The company has secured a franchise to enter the city. It is expected to have the proposed railway in operation between Gastonia and Charlotte, and probably Salisbury, in about six months.

GREENSBORO, N. C.—It is reported that the Southern Power Company has decided to locate one of its three large auxiliary plants in Greensboro.

GREENSBORO, N. C.—Preparations are being made by the Southern Bell Telephone Company for extensive improvements to its local system which will involve an expenditure of about $40,000 and include the installation of six miles of underground and aerial cables to replace the present overhead wires, and also the erection of several hundred miles of rural telephone lines. E. A. Woodruff is local manager.

RALEIGH, N. C.—The directors of the state prison are reported to be contemplating the installation of an electric light plant at the convict farm.

CAMBRIDGE, OHIO.—The capital stock of the Cambridge Home Telephone Company has been increased from $25,000 to $50,000. J. M. McKitterick is president of the company.

CLEVELAND, OHIO.—Preparations are being made by the city to place all wires in connection with the municipal electric plant under ground during the coming winter. It is said that the change will be made when the lighting system is extended to the new territory recently acquired by the city. The new street lighting system will include about 400 magnetite lamps, which will be installed at a cost of from $50,000 to $75,000. The present plans call for the installation of two new substations, a new switchboard, new poles and wire.

COLUMBUS, OHIO.—Sealed proposals will be received by H. S. Holton, director of public service, Columbus, Ohio, until Oct. 3, for furnishing ornamental lamp standards for the Mound Street viaduct. The plans call for eight standards with provision for five lamps each and fifteen standards with provision for one lamp each.

HUDSON, OHIO.—The contract for construction of the power house for the municipal electric light plant has been awarded to Philip Schmid, of Youngstown, Ohio, and for garbage disposal plant to A. A. Dittrick, of Cleveland, Ohio. D. M. Hosford is engineer.

IRONTON, OHIO.—Preparations are being made by the Norfolk & Western Railway Company for the erection of a large signal tower in Ironton, at a cost of about $36,000.

JACKSON, OHIO.—Owing to a misunderstanding regarding the legal requirements the date for receiving bids for machinery, lamps, etc., in connection with extensions and improvements to the municipal electric light plant at Jackson, Ohio, has been extended from Sept. 29 to Oct. 20. W. A. Dallas is clerk.

DURANT, OKLA.—The City Council has awarded a contract to the Westinghouse Electric & Manufacturing Company for the installation of an electric plant in Durant. The cost of the plant is estimated at about $20,000.

STILLWATER, OKLA.—The Oklahoma Public Service & Interurban Railway is reported to be contemplating the construction of a power house at Stillwater. R. A. Sturgeon is chief engineer.

TALIHINA, OKLA.—Plans are being considered to increase the output of the municipal electric plant. It is proposed to install a 35-kw, single-phase, alternating-current generator and an automatic high-speed engine.

TECUMSEH, OKLA.—The City Council has granted the Rapid Transit Interurban Company a franchise to construct an electric railway in Tecumseh. The company has received authority from the Commissioners of Pottawatomie County to cross all highways. It is expected that work will commence soon on construction of the railway.

TULSA, OKLA.—The Tulsa Corporation is reported to be contemplating the installation of additional machinery in its electric light plant, including a 500-kw turbo-generator set, two boilers with a total rating of 1000 hp, and condensers.

BAKER CITY, ORE.—Plans are being considered by the Commercial Club for the installation of an ornamental street lighting system in Baker City.

EUGENE, ORE.—The Tri-State Railway & Power Company has been granted a franchise for the erection of an electric transmission line from Eugene to Albany.

NYSSA, ORE.—The City Council has granted the Idaho-Oregon Light & Power Company a twenty-five-year franchise to install an electric light system in Nyssa.

PORTLAND, ORE.—Plans are being made by the United States engineers to install an electric light plant at Big Eddy so that work on The Dalles-Celilo Canal can be continued both day and night. Lieut. H. H. Robert is local officer in charge of the work.

PORTLAND, ORE.—The Portland Railway, Light & Power Company is reported to be contemplating increasing the output of its steam plant located near the Eastern & Western Lumber Company's mill. A generator and battery of boilers will be installed. O. B. Coldwell is electrical engineer.

PORTLAND, ORE.—Extensive improvements and additions are being made to the East Side power plant of the Portland Railway, Light & Power Company, including the installation of eight 450-hp Babcock & Wilcox boilers, ten Copes feed water-heater regulators, a Weber chimney, a Hamilton-Corliss engine direct connected to a 2000-kw General Electric generator. Charles C. Moore & Company, of San Francisco, Cal., have charge of the work.

ALLEGHENY, PA.—The American Locomotive Company is reported to be contemplating the construction of a power house, 50 ft. x 65 ft., at Allegheny, Pa., plans for which have been prepared.

ALLENTOWN, PA.—The Lehigh Valley Transit Company is reported to have secured franchises which will permit it to build an electric railway from Quakertown to Perkasie.

DILLSBURG, PA.—The construction of an electric railway from Dillsburg to Dover, a distance of about fifteen miles, is under consideration. It is proposed to organize a company capitalized at $180,000 to build the proposed road. Local capitalists are interested in the project.

DUQUESNE, PA.—It is reported that the installation of a power and heating plant in the new municipal building in Duquesne, Pa., is under consideration.

ECONOMY, PA.—The Inter-Borough Electric Company has secured permission from the War Department to lay a cable, 1375 ft. in length, across the Ohio River, near Economy, work on which will start very soon. The cable will supply electricity in Woodlawn and other towns.

PHILADELPHIA, PA.—It is reported that the Pennsylvania Railroad is planning to equip its main line for electrical operation as far as Waverly, and is also preparing plans to extend its electrical zone about thirty miles further into New Jersey. It is expected to have the railroad ready for electrical operation as far as Newark by April 1, 1911. It is understood that the Hudson & Manhattan Railroad Company, which operates the Hudson River tubes, is contemplating putting in operation during 1911 a rapid-transit system from Newark to connect with the tubes at Jersey City.

PHILADELPHIA, PA.—The new lighting system installed by the Philadelphia Electric Company was put in operation Sept. 15. Nearly 1000 twin arc lamps of 2000 cp erected throughout the city, including the 350 in the central business section, were lighted for the first time. The new lamps were installed by the company at a cost of $200,000. The street lighting system has been increased by the installation of 1129 arc lamps this year, making a total of 13,600. The cost for maintaining each lamp is $100.06 per year, making an increase in the cost of street lighting $112,967. The entire cost for next year is estimated at $1,306,783. Mayor Reyburn has given his approval to a design for the memorial electric lamp standards to be erected around Independence Hall and in Independence Square. It is proposed to erect fifty-six lamp standards, one for each signer of the Declaration of Independence, and each bearing three 2000-cp arc lamps. The standard was designed by the Philadelphia Chapter of the American Institute of Architects. It is expected to have the lamps installed by Jan. 1, 1911.

WOODVILLE, PA.—The contract for installing a feeder system for electric lighting for buildings at the Allegheny County Home, at Woodville, Pa., has been awarded to the Morganstown Electric Company, 355 Second Avenue, Pittsburgh, Pa. R. J. Cunningham is county controller.

TIVERTON, R. I.—The Town Council has entered into a contract with the Tiverton Electric Light Company for lighting the town for a period of fifteen years. Under the terms of the contract the company is to furnish not less than 100 60-cp incandescent electric lamps at $25 each per year. The company also agrees to pay the town a special tax of 1 per cent of its gross earnings.

CHARLESTON, S. C.—The Charleston Consolidated Railway & Lighting Company has awarded the contract for construction of its power plant at foot of Charlotte Street to the Gadsden Contracting Company, of Savannah, Ga. The power house will be 120 ft. square, two stories high. Orders have been placed for the equipment, consisting of one 1000-kw turbo-generator set, two 2000-kw turbo-generator sets, three 500-kw motor generators, two 100-kw turbine exciters, one 35-kw motor generator exciter, with switchboards, wiring, piping and connections; intake and discharge condensers, artesian well and boilers with a total rating of 3000 hp. One 1000-kw turbo-generator set, with switchboard, exciter and accessories, will be installed in the present power house. The cost of the work is estimated at $200,000. George H. Waring is general manager.

GREENVILLE, S. C.—The River Falls Company, recently organized to develop a town site, is reported to be contemplating the installation of an electric light plant, water and sewage systems. For further information address W. H. Patterson, 231 Candler Building, Atlanta, Ga.

GREENVILLE, S. C.—The State Railroad Commission has granted the local Southern Bell Telephone Company permission to increase its telephone rates, on condition that the company would make improvements to the local system at a cost of $100,000, the increased rates not to become effective until the improvements have been made. The work will include the erection of a new exchange building, the installation of underground conduits and modern equipment.

SPARTANBURG, S. C.—The Georgia & Carolina Railway Company will soon apply for a charter in South Carolina to construct an electric railway from Hamburg to Spartanburg, a distance of 120 miles. The capital stock of the company is placed at $100,000, to be increased later to $2,500,000. The incorporators are: Allen W. Jones, Charles C. Howard and G. R. Coffin, of Augusta, Ga.; A. E. Pafgett, of Edgeville, and Daniel Crosland, of Aiken, S. C.

DEADWOOD, S. D.—The Consolidated Power & Light Company is reported to have awarded the contract for the construction of an addition to its power house to Mullen & Rourke, of Deadwood, S. D. The cost of the work is estimated at about $40,000.

ONIDA, S. D.—The Onida Electric Light & Power Company has been granted a twenty-year franchise to construct and operate an electric light plant in Onida.

KNOXVILLE, TENN.—It is reported that Eastern capitalists have purchased from the Knoxville Power Company its riparian rights, seven and one-half miles of river frontage property, several thousand acres of land and all other holdings for a hydroelectric power plant on the Little Tennessee River. The new owners, it is said, will commence work at once on the development of the water power on the Little Tennessee River with a view of supplying electricity in Knoxville and other towns and cities in Eastern Tennessee. The cost of the plant is estimated at $3,000,000. R. W. Austin was one of the promoters of the Knoxville Power Company.

SPARTA, TENN.—The Home Telephone Company, recently incorporated, is planning to construct a telephone line to connect Cookeville and Smithville, a distance of fifteen miles. C. W. Roberts is manager.

AUSTIN, TEX.—The City Council is considering an ordinance requiring the Southwestern Telegraph & Telephone Company to place its wires underground on certain streets in the city.

HOUSTON, TEX.—The contract for construction of power plant and engineering laboratory of the William M. Rice Institution is reported to have been awarded to William Miller & Sons, of Pittsburgh, Pa., and Houston, Tex., for $182,430.

SAN MARCOS, TEX.—The City Council has granted the San Marcos Utilities Company an extension of its franchise for a period of twenty years, in return for which the company is to pay a franchise tax of 3 per cent on its gross earnings and to supply electricity to private consumers for lamps as follows: For the first 20 kw-hours at 15 cents per kw-hour; 12½ cents per kw-hour for the next 20 kw-hours and 10 cents for all above. The company is contemplating making extensive improvements to its plant.

VERNON, TEX.—We are informed that the Vernon Light & Power Company is contemplating making extensive improvements to its system which will double the output of the plant in the near future. L. H. Sullins is superintendent.

WACO, TEX.—The civic improvement committee of the Business Men's Club is reported to be ready to receive bids for the installation of an ornamental lighting system for the business section of the city. C. W. Coons is secretary of the club.

PARK CITY, UTAH.—The auxiliary steam plant of the Park City Electric Light Company was recently destroyed by fire.

EMPORIA, VA.—The hydroelectric power plant of the Emporia Hydro-Electric Corporation has been completed and will soon be put into operation. The plant will develop about 1000 kw and cost about $200,000.

PETERSBURG, VA.—The Southern Timber & Land Company is reported to be in the market for electrical equipment for operating a band mill, and would like to correspond with parties interested. J. W. Seward is president of the company.

BRATTLEBORO, VT.—Negotiations are under way between the Board of Trade and M. Z. Chase, of Providence, R. I., and H. L. Harriman, of Hyde Park, Mass., for the establishment of cotton mills in Brattleboro, costing about $500,000. The promoters ask for a free site, subscription for $120,000 of the capital stock and exemption from taxes for a period of years. It is proposed to operate the mill by electricity obtained from the plant of the Connecticut River Power Company, at Vernon, Vt.

PASCO, WASH.—The appropriation for the Water and Light Department has been increased by $3,000 for the purpose of extending the lighting system to the residence portions of the city.

SEATTLE, WASH.—At an election to be held Nov. 8 a proposition to issue $1,400,000 in bonds, the proceeds to be used for extending and enlarging the municipal electric light plant, will be submitted to a vote.

SEATTLE, WASH.—The City Council has passed an ordinance providing for enlarging and extending the municipal electric light plant, which will call for an expenditure of about $1,400,000. A special election will be held in November to vote on the proposition to issue bonds to pay for the improvement.

SPOKANE, WASH.—Announcement has been made by H. H. Shallenberger, secretary of the International Lead & Iron Company, that a town is being laid out at Salmon Rapids, and preliminary surveys have been made for the installation of a 65,000-hp electric power plant on the Salmon River.

TACOMA, WASH.—The Puget Sound, Chelan & Spokane Railway Company, recently incorporated with a capital stock of $25,000,000, has engaged the W. K. Palmer Company, engineers, 717-720 Dwight Building, Kansas City, Mo., as consulting engineers to take charge of all its engineering work and supervise construction. The railway company proposes to develop about thirty hydroelectric properties in the State of Washington, aggregating more than 300,000 hp, and the construction of about 1200 miles of electric railway.

JARROLDS VALLEY,, W. VA.—It is reported that the Seng Creek Coal Company is in the market for complete equipment of electrically operated machinery for its mines, bids for which will be opened in October.

WELCH, W. VA.—The contract for the construction of the power house at the Miners' Hospital has been awarded to the J. D. Shott Paving Company, of Bluefield, W. Va.

WHEELING, W. VA.—The Wheeling Traction Company is reported to have awarded the contract for additional equipment for its power station to the Westinghouse Electric & Manufacturing Company, consisting of an 1800-kw low-pressure steam turbine, operating on exhaust steam, and two 500-kw motor generator sets.

GREEN BAY, WIS.—It is reported that the Green Bay Barker Company, recently organized, is contemplating establishing a factory at Green Bay, Wis., for manufacturing a machine designed for stripping bark from pulp wood in large mills. It is understood that the plant will be equipped for electric motor drive. Electricity for operating the plant will be purchased from the Northern Hydroelectric Power Company.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company has been granted a franchise by the City Council to extend its tracks on Seventh Street and Eleventh Street.

NEENAH, WIS.—The Hardwood Products Company, it is reported, will erect a three-story factory, 40 ft. x 60 ft., with the co-operation of the Neenah Industrial Association in Neenah. A separate power plant will be erected. It is understood that the plant will be equipped for electrical operation.

OSHKOSH, WIS.—The Waite Grass Carpet Company is reported to be contemplating the purchase of a number of electric motors during the fall.

RACINE, WIS.—The Racine Manufacturing Company, it is reported, will soon be in the market for equipment, including motors, for the addition to be made to its plant.

COMOX, B. C., CAN.—Surveys are being made in connection with the project of the Canadian Collieries (Dunsmuir), Ltd., for the development of a large hydroelectric plant on the Puntledge River in the center of the Comox coal field in British Columbia, where it is estimated that 50,000 hp. can be developed. Electricity generated at the plant will be utilized in operating a system of compressed air haulage in the mines and machinery in various plants and also to operate a 14-mile railway connecting the different collieries with the ore bunkers at Union Bay.

WINNIPEG, MAN., CAN.—Bids will be received by the Board of Control until Oct. 7 for a motor car for use on standard-gage railway track. M. Peterson is secretary of board.

LONDON, ONT., CAN.—Contracts have been awarded by the Water Commissioners for electrical equipment for the Springbank pumping station as follows: For two 3,000,000-gal. turbine pumps to the John McDougall Iron Works Company; to the Canadian Westinghouse Company for two 250-hp self-starting, synchronous motors with direct-connected exciters; for two 350 kva, 3 phase, 13,200 to 2300-volt, self-cooled transformers, to the Allis-Chalmers-Bullock Company, and for switchboard equipment to Siemens Brothers. H. J. Glaubitz, Continental Life Building, Toronto, Ont., Can., is consulting engineer.

TORONTO, ONT., CAN.—Application has been made to the Hydro-Electric Power Commission by the municipalities of Morrisburg and Prescott for service, and the commission has instructed the engineer to furnish them with an estimate of the cost upon the price received from the Ontario Power Company. It is understood that the price to Morrisburg, where 2000 hp was asked for, will be $16.33 per hp per year, and to Prescott, which desires 1000 hp, the rate will be $22.12 per hp per annum.

WINDSOR, ONT., CAN.—At a meeting of the representatives of the municipalities using electricity supplied by the Hydroelectric Power Commission, held recently, it was decided that the city of Windsor should be allowed to export part of power taken from the commission to Detroit, Mich. Under the agreement made with the commission energy will be supplied to Windsor at the following rates: For 5000 hp, $48 per horse-power per year; $33 per horse-power per year for 10,000 hp; $28 per horse-power for 15,000 hp, and $25 per horse-power for 20,000 hp.

MONTREAL, QUE., CAN.—The Board of Control is reported to have decided to recommend to the City Council to accept the bids of the Montreal Light, Heat & Power Company for lighting the streets for a period of ten years. The company submitted a proposition offering to supply 1650 lamps or over at $72.70 each, on schedule "A," and $63.15 on schedule "B."

YORKTON, SASK., CAN.—Bids will be received until Oct. 11 by T. F. Acheson, secretary and treasurer, for equipment for an electric light plant as follows: Section 1, boilers; section 2, engines, piping, etc.; section 3, generators, switchboard and arc lamps; section 4, transformers; section 5, meters. Specifications may be obtained from W. E. Skinner, Ltd., consulting engineers, Winnipeg, Man., Can., or from T. F. Acheson, secretary and treasurer.

New Industrial Companies.

THE AEROCRAFT COMPANY, of Chicago, Ill., has filed articles of incorporation with a capital stock of $10,000 for the purpose of manufacturing motors. The incorporators are: Benjamin L. Gates, Hugh H. Abernathy and Joseph J. Zini.

THE AMERICAN STORAGE BATTERY COMPANY, of Cambridge, Mass., has been incorporated with a capital stock of $50,000 for the purpose of manufacturing and dealing in storage batteries. F. F. Sullivan, of Auburndale, Mass., is president, and C. M. Ludden, of Waltham, Mass., treasurer.

THE CABLE CARRIER & TELEPHONE COMPANY, of Aurora Ill., has filed articles of incorporation with the Secretary of State at Dover, Del., with a capital stock of $200,000 for the purpose of manufacturing a motor car running on a wire and used for delivering parcels.

THE CHICAGO ACME CLEANER COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing vacuum cleaners and to operate same. The incorporators are: Charles H. Wolfe, George F. Nicklaus and Monroe Fulkerson.

THE ELECTRIC DISINFECTING & PERFUMING COMPANY, of New York, N. Y., has been chartered by E. J. Forhan, G. F. Martin and H. P. Jones, all of 154 Nassau Street, New York, N. Y. The company is capitalized at $25,000 and proposes to manufacture machines for disinfecting and perfuming.

THE ELECTRIC LIGHTING COMPANY, of Indianapolis, Ind., has filed articles of incorporation with the Secretary of State with a capital stock of $100,000 for the purpose of manufacturing a device for lighting vehicles with electricity; also to manufacture automobile parts and accessories, electric supplies, etc. The directors are: C. C. Wedding, S. C. Renick and H. H. Harbinger.

THE ELECTRICAL SIGNALING COMPANY, of St. Louis, Mo., has been incorporated by Charles H. Parshall, Herbert A. Vrooman and Arthur G. Mosely. The company is capitalized at $50,000 and proposes to manufacture and deal in signal devices.

THE FLEXUME SIGN COMPANY, of Buffalo, N. Y., has been chartered with a capital stock of $125,000 by R. R. Wiley, W. K. Wiley, of St. Catharines, Ont., and W. C. Wallace, of Niagara Falls. The company proposes to manufacture advertising devices, illuminated signs, etc.

HOLMAN BROTHERS, of New York, N. Y., have filed articles of incorporation with a capital stock of $25,000 by P. Angwin, H. S. Brussell, of New York, N. Y., and E. W. Beebe, of East Orange, N. J. The company proposes to manufacture and deal in all kinds of machinery.

THE INTERSTATE CONSTRUCTION COMPANY, of Hammond, Ind., has been incorporated by Frank O'Shea, John C. Lavernie and Inace Schia. The company is capitalized at $30,000 and proposes to make a specialty of constructing electric railways.

THE METALLIC WELDING & MANUFACTURING COMPANY, of Louisville, Ky., has filed articles of incorporation with a capital stock of $5,000 for the purpose of engaging in the electrical, steel and repair business. The incorporators are: E. L. Hughes, of Louisville, Ky.; George M. Bailey, of Kansas City, Mo., and I. Bailey, of Madisonville, Mo.

THE NATIONAL BOAT & ENGINE COMPANY, of Augusta, Maine, has filed articles of incorporation with a capital stock of $1,000,000 for the purpose of manufacturing power and small boats and vehicles of all kinds propelled by mechanical power, etc. R. S. Buzzell is president and M. M. Farrar, of Augusta, Maine, treasurer.

THE OVERLAND SALES COMPANY OF NEW YORK, of Setauket, N. Y., has been incorporated by C. T. Silver, of New York, N. Y.; E. A. Widham and J. A. S. Schaefer, of Brooklyn, N. Y. The company is capitalized at $100,000 and proposes to deal in motors, engines, etc.; also in wagons, boats and vehicles of all kinds.

THE PATENT ELECTRIC FUSE SPITTER COMPANY, of Mokelumne Hill, Cal., has been incorporated with a capital stock of $200,000 by J. B. Sayve, T. C. Peters and F. M. Sorasco, of Sutter Creek, Cal.

THE PELLER MANUFACTURING COMPANY, of New York, N. Y., has filed articles of incorporation for the purpose of manufacturing metal lamps, gas and electric fixtures, etc. The incorporators are: Emanual Feller, 29 Riverdale Avenue, Yonkers, N. Y.; Osias Buchalter, 293 East Third Street; Max Garfinkel, 249 South Second Street, New York, N. Y. The company is capitalized at $2,500.

THE FRANK P. PERKINS COMPANY, of Belford, N. J., has been chartered by E. H. Lane, L. Harang, of Brooklyn, N. Y., and F. P. Perkins, of Belford, N. J. The company is capitalized at $50,000 and proposes to do a general electrical engineering business.

THE SAGAMORE ENGINE COMPANY, of Portland, Maine, has been chartered with a capital stock of $40,000 for the purpose of manufacturing and selling engines and other machinery. H. M. Patten, of Stoneham, Mass., is president, and L. C. Wade, of Lynn, Mass., treasurer.

THE SAURER MOTOR TRUCKS has filed articles of incorporation with a capital stock of $1,000,000 for the purpose of manufacturing automobiles and accessories. W. M. Thompson, of Chicago, Ill., is incorporator.

THE SHAFFER MOTOR COMPANY, of New York, N. Y., has been incorporated by C. W. Shaffer, 1851 Broadway, New York, N. Y.; Earle W. Webb, 141 Broadway, New York, N. Y., and John L. Little, 45 Cedar Street, New York, N. Y. The company is capitalized at $100,000 to manufacture and deal in motors, engines, machinery, etc.

THE SHEET METAL SPECIALTY COMPANY, of Evansville, Ind., has been incorporated by Jesse, Frederick and Edna Helser. The company is capitalized at $10,000 and proposes to manufacture car fenders.

THE SHIELD ELECTRIC COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $5,000 for the purpose of dealing in electric and other kinds of machinery. The incorporators are: Ernest E. Schmid, 557 West 124th Street; Robert M. Schmid, 23 Beekman Place; Charles P. Schmid, 2400 Seventh Avenue, all of New York, N. Y.

THE DAN SMITH ROTARY ENGINE COMPANY has filed articles of incorporation with the Secretary of State with a capital stock of $2,000,000. The incorporators are: J. H. Adams, P. A. Hatting, of New York, N. Y., and C. K. Kelly, of Philadelphia, Pa.

THE SOUTHERN ELECTRIC COMPANY, of St. Louis, Mo., has been chartered with a capital stock of $6,000 by Wilfred Hearn, W. H. Close and C. Schnyder.

THE SOUTHERN ENGINEERING COMPANY, of Jacksonville, Fla., has been organized by Alfred Oldfield and Horace P. Ramey, 411-412 Clark Building, Chicago, Ill., for the purpose of doing a general engineering business in the Southern States, making a specialty of water-power development, municipal work and colonization projects.

THE VARIABLE POWER GAS ENGINE COMPANY, of New York, N. Y., has been chartered with a capital stock of $50,000 by A. Bolognesi, Aldo Bolognesi and Alfredo Bolognesi, of New York, N. Y. The company proposes to manufacture machinery, etc.

THE WALRATH-MAXIM GAS ENGINE COMPANY, of Jersey City, N. J., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing gas engines. The incorporators are: H. O. Coughlan, L. H. Guenther and A. H. Jarvis, of Jersey City, N. J.

New Incorporations.

AUBURN, CAL.—The Sunset Power Company has been incorporated with a capital stock of $500,000 by C. B. Greeley, Theodore Tremer, of Alameda, Cal., and William L. Boos, of San Francisco. The company is interested in mining and power propositions in Placer County.

LOS ANGELES, CAL.—Articles of incorporation have been filed for the Midway Light & Power Company with a capital stock of $250,000 for the purpose of generating and distributing electricity for lamps, heaters and motors. Plants will be located at Maricopa and Moran and the head office will be in Los Angeles. The directors are: H. L. Dearing, of Los Angeles, Cal.; E. F. Hughes, of Sierra Madre, Cal.; Herbert Williams, of Los Angeles, Cal.; H. J. Goudge, of Alhambra, Cal., and C. L. Chandler, of South Pasadena, Cal.

DENVER, COL.—Articles of incorporation have been filed by the Denver Tramway Terminals Company, whose purpose is to build a terminal for the Denver City Tramway Company, the incorporation papers having been filed in the interests of the latter company. It is also the intention of the Denver Tramway Terminals Company, which is capitalized at $1,400,000, to construct two loop lines.

DOVER, DEL.—Articles of incorporation have been filed for the Cities Service Company with the Secretary of State with a capital stock of $50,000,000. The company is a holding company for the consolidation of the Denver Gas & Electric Company, the Empire District Electric Company and the Spokane Gas & Fuel Company. Henry L. Doherty will be president of the new company and associated with him will be James M. Beck, of New York, N. Y.; Leslie M. Shaw, of Philadelphia, Pa; Denis Sullivan, of Denver, Col.; Frank W. Frueauff, of Denver, Col.; C. T. Brown and H. H. Scott, of New York, N. Y.

OKAWVILLE, ILL.—The Okawville Electric Light & Ice Company, capitalized at $10,000, has been incorporated to install, maintain and operate an electric light plant at this city. Among the incorporators are: John Fietsam, John J. Frank and William F. Hagebush.

BATESVILLE, IND.—Articles of incorporation have been filed for the Batesville Electric Light & Power Company by John A. Hildebrand, A. W. Bomweber and Harry Blank. The company is capitalized at $10,000 and proposes to establish an electric plant to supply electricity for lamps, heaters and motors in Batesville and other cities and adjacent towns.

MAXWELL, IND.—Articles of incorporation have been filed for the Maxwell Telephone Company by John H. Mugg, T. A. Seamans, R. A. Albea, George B. McClaren and John R. Shipley, directors of the company. It is the purpose of the organizers to construct and operate a telephone system to Maxwell and throughout Hancock county.

HAGERSTOWN, MD.—Articles of incorporation have been filed by the Mount Aetna Rural Telephone Company, with its principal office at Hagerstown, for the purpose of constructing and operating a telephone system in Washington County. Among those interested in the proposition are: C. H. Keller, William O. Funk, Henry C. Wolfe and others.

SANDSTONE, MINN.—The Clover Belt Telephone Company has been incorporated with a capital stock of $50,000 by J. H. Ingraham, Hugo Wickber, M. Bullis and others.

CHARLOTTE, N. C.—The Charlotte Rapid Transit Company, with an authorized capital stock of $150,000, has been incorporated for the purpose of constructing a street railway in Charlotte and the suburban districts. Among those interested in the proposition are: Cameron Morrison and Paul Chatham, Charlotte; Hugh Chatham, Elkin, and J. E. Kavanaugh, Winston-Salem.

CARSON, VA.—Articles of incorporation have been filed by the Tri-County Telephone Company, which contemplates the construction and operation of a telephone system in this city. The capital stock is given at $5,000, and the following officers have been elected: W. B. Daniel, Disputanta, president; Timothy Rives, Petersburg, Va., vice-president; E. T. Birdsong, Disputanta, secretary and treasurer.

GRUNDY, VA.—The Grundy Home Telephone Company has been formed by G. T. Hawkins, L. W. Farley and others. The company is capitalized at $2,000 and proposes to install a telephone system in Grundy and erect lines in Buchanan County.

Personal.

MR. GUGLIELMO MARCONI nas sailed on the *Princess Mafalda* from Buenos Ayres for Italy to be at his home while recovering from sickness.

MR. J. F. MEISTER, a graduate of Cornell University, has been appointed instructor in electrical engineering at the Oregon Agricultural College, Corvallis, Ore.

MR. IRVING W. PHILLIPS, formerly of San Francisco, has accepted a position with the Stone & Webster Engineering Corporation and is now connected with its Minneapolis office.

MR. C. J. ERICKSON has joined the staff of the Texarkana Gas & Electric Company, Texarkana, Ark. Mr. Erickson succeeds Mr. R. G. Stewart as superintendent of the railway department.

MR. DANIEL W. BOWIE, who has been assistant city electrician of Atlanta, Ga., for the past two years, has been appointed city electrician to fill the position left vacant by the resignation of Mr. Fred Miles.

MR. WALTER I. SWEET, of Port Richmond, has been appointed by the New York Public Service Commission to be assistant chief of the Division of Telephones and Telegraphs. Mr. Sweet will have charge of the New York office.

DR. BERTRAM B. BOLTWOOD, formerly assistant professor of physics at Yale, has been made head of the newly created department of radio-chemistry at the university. Dr. Boltwood spent one year in Europe making a special study of radio-chemistry.

MR. W. L. ABBOTT, chief operating engineer of the Commonwealth Edison Company, Chicago, has been renominated by the Republican State Convention as a trustee of the University of Illinois. Mr. Abbott, who is a graduate of the university, is now serving as president of the board of trustees.

MR. HENRY B. SEAMAN has tendered his resignation as chief engineer of the New York Public Service Commission, to take effect Oct. 1. Mr. Alfred Craven, formerly assistant to Engineer G. S. Rice under the old Rapid Transit Commission, and more recently assistant to Mr. Seaman, will be appointed acting chief engineer.

Mr. H. A. SINCLAIR, for many years the treasurer of the New York Electrical Society, has resigned, much to the regret of the officers and members, who appreciate his loyal and devoted service. He has been succeeded by Mr. Kingsley Gould Martin, of the New York Edison Company, and son of Mr. T. C. Martin, secretary of the National Electric Light Association. The coming season marks the fortieth year in the history of the society, the oldest body of the kind in this country.

MR. H. T. EDGAR, manager of the Northern Texas Traction Company, Fort Worth, Tex., has been appointed general manager of the Seattle (Wash.) Electric Company. Mr. Edgar has been connected with public service corporations for a number of years. Early in 1898 he was appointed manager of the Lowell (Mass.) Electric Light Corporation, and in September, 1901, was transferred by Stone & Webster to El Paso, Tex., becoming vice-president and manager of the El Paso Electric Railway. Five years ago he was appointed manager of the Northern Texas Traction Company.

MESSRS. R. B. ROBERTS, JR., AND P. N. GOLDEN, engineers representing Henry Floy, consulting engineer in charge of the design and installation of the new central station of the Middletown Electric Light Company, Middletown, Conn., started the new plant in successful operation the early part of September and it is now regularly carrying the larger portion of the municipal and commercial lighting load. The work on the new plant did not begin until early in May, making only a little over three months from time of beginning work until the plant was delivering electrical energy. Considering the fact that the building had to be erected on piles, and that the entire superstructure to an elevation approximately ten feet above ground level is built of concrete and made waterproof, this is an unusual record.

MR. MATHIAS KLEIN, the senior member and founder of the firm of Mathias Klein & Sons, Chicago, was agreeably surprised on Sunday, Sept. 18, on his return from an afternoon outing, by the assembly of his descendants who had gathered at the old homestead to bring their congratulations for his eighty-fourth birthday. Mr. Klein has lived at the old homestead for fifty-four years. It is now practically in the heart of the North Side, but in the early days it was decidedly on the outskirts of the city. Mr. Klein still enjoys bodily and mental vigor. Born in the City of Worms, Hessendarnstadt, Germany, in 1826, he served his time as apprentice and journeyman in the Fatherland and in 1848 determined to turn to the new land of promise. Until 1855 he resided in the City of Philadelphia, working at his trade for the then prevailing wage of $6 per week. He married in Philadelphia, and in 1855 moved to Chicago. He was employed until 1857 in the repair and mechanical department of Edwin Hunt, a prominent hardware merchant of that time. In 1857 Mr. Hunt decided to abandon this part of his business, which Mr. Klein took up with the best wishes of Mr. Hunt, opening up on his own account in a small shop in Couch Place, between Lake and Randolph and Clark and Dearborn Streets. This was the beginning of the present firm of Mathias Klein & Sons.

Obituary.

MR. GEORGE POOLE, who, in conjunction with the late Mr. Henry L. Carter, established the hydroelectric plant of the York Haven Water & Power Company, died at New Hartford, Conn., on Sept. 24, at the age of fifty-six years. Mr. Poole was formerly vice-president of the York Haven Paper Company, and at the time of his death was president of the Poole Engineering and Machine Company, Baltimore.

MR. J. D. VOLTZ, of Elgin, Ill., a man with an electrical name and for fifty-five years a telegraph operator, died recently. During the civil war Mr. Voltz was a military telegrapher in the federal service and he is credited with sending from Rome, Ga., to President Lincoln the message outlining General Sherman's famous march through Georgia to the sea. A year ago Mr. Voltz was retired on a pension by the Chicago & Northwestern Railway Company, by which he had been long employed as a station agent.

MR. GABRIEL L. FELDMAN, for many years a leading expert in the electroplating industry, died at Spring Lake, N. J., on Sept. 16, following an operation for appendicitis. Mr. Feldman was born in Philadelphia fifty-four years ago and was a resident of Newark for forty years. For the past thirty-five years he was connected with the Hanson & Van Winkle Company, advancing through various positions to that of secretary, which office he held at the time of his death. He leaves a widow, four daughters and three sons.

Trade Publications.

ALTERNATING-CURRENT MOTORS.—The Gregory Electric Company, Chicago, Ill., has issued a booklet showing a complete assortment of Wagner single-phase and polyphase motors applied to various classes of machinery.

MOTORISTS' HANDBOOK.—The National Carbon Company, Cleveland, Ohio, has just issued the seventh revised edition of its handbook on the operation of motor cars and motor boats. Much that is of interest and benefit to the owners of automobiles or motor boats is included within the thirty-two pages of the publication.

ELECTRICAL LABORATORY APPARATUS.—The Thordarson Electric Manufacturing Company, Chicago, Ill., has issued an illustrated catalog describing its laboratory apparatus, coils and special electric devices. The apparatus is designed to cover all electric dynamic experiments and is quickly dismantled and assembled for any condition required.

LAUNDRY MACHINERY.—The American Laundry Machinery Company, Chicago, New York, etc., has issued a very complete catalog in which machines covering the whole range of laundry work are illustrated and described. Each of the six companies absorbed by the American Laundry Machinery Company stood in the foremost ranks of the laundry machinery industry and since the amalgamation of these companies further developments have added much to the efficiency of the apparatus. The growing tendency in favor of motor-driven machinery rather than the separate purchase of motors and machines has caused the company to establish an electrical department whose entire effort is devoted to the development of electrical equipment solely for laundry machinery. Much of the apparatus designed by this department is included in the catalog.

BUSINESS NOTES.

THE PITTSBURGH TESTING LABORATORY, inspecting and consulting engineer and chemist, Pittsburgh, Pa., has moved its New York office from 1 Liberty Street to 50 Church Street. The company's interests in New York and New England have been placed in the hands of Mr. Wm. F. Zimmerman, the second vice-president of the company.

PITTSBURGH OFFICE OF THE BUCKEYE ELECTRIC COMPANY.—The Buckeye Electric Company, of Cleveland, has located in the Fulton Building, Pittsburgh, a branch office to assist in the more rapid and efficient service of the lamp trade in that territory. Mr. Foster, who will be in charge of the office, is well known to the incandescent lamp fraternity and is no stranger to Pittsburgh, although for two years much of his time was spent in Indiana.

THE W. K. PALMER COMPANY, engineer, Kansas City, Mo., has been retained by the Puget Sound, Chelan & Spokane Railway Company, a $25,000,000 corporation with headquarters in London, New York and Tacoma, as consulting engineers for, and to supervise the construction of, about thirty hydroelectric properties in the State of Washington, aggregating more than 300,000 hp, and also 1200 miles of railway to be operated by electric power from these plants.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 20, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

970,473. MANUFACTURE OF LUBRICATING OILS; Alexandre de Hemptinne, Ghent, Belgium. App. filed May 11, 1909. Changes oils into a viscous product by means of a silent electric discharge.

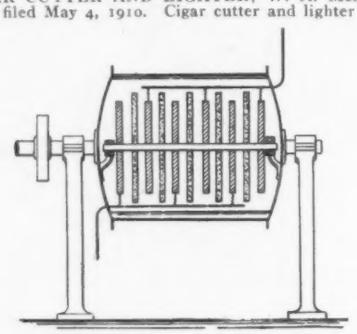
970,478. CIRCUIT CONTROLLING DEVICE; F. Dunning, Schenectady, N. Y. App. filed June 10, 1910. For electric motors of the squirrel-cage type, including a starting switch and a running switch biased to open position, and an operating handle therefor with electrical means for locking the running switch in closed position.

970,488. MEANS FOR HEATING METALS; E. F. Gehrkens, Schenectady, N. Y. App. filed July 6, 1908. A magnetic core with a winding and a gap with a piece of metal partly in the gap and partly in inductive relation to the winding.

970,498. ELECTRIC METER; J. Harris, Lafayette, Ind. App. filed May 3, 1909. Mercury meter, the mercury conveying the current to the armature and means for varying portions of the liquid included in the pressure circuit.

970,523. CIRCUIT CONTROLLING DEVICE; J. K. Lux, Washington, D. C. App. filed Feb. 12, 1907. A rotary snap switch with a plurality of electrical contacts, a movable contact connecting the electrical contact, means for operating the movable contact, a detent therefor and a carrier with lugs for stopping the detent.

970,533. CIGAR CUTTER AND LIGHTER; W. A. McAneny, Denver, Col. App. filed May 4, 1910. Cigar cutter and lighter avoiding waste



970,473.—Manufacture of Lubricating Oils.

of the battery charge by shifting the electrode out of the path of the lighter prior to the return stroke.

970,556. LIGHTNING PROTECTOR; A. F. Rosenberger, Chicago, Ill. App, filed Jan. 2, 1908. A pair of electrodes with parallel contacting portions and divergent gap surfaces with insulating material between and with its edge coincident with the angle of the gap.

970, 581. ELECTRIC LIGHT SOCKET; W. H. Walters, Salt Lake City, Utah. App. filed Nov. 13, 1909. A three-point socket including a threaded shell, opposite contact bars on the shell, each bar having a bearing and a stem of insulating material slidable in the bearing with a contact maker on the stem for connecting either of the bars to the shell.

970,587. LAMINATED TRANSFORMER CORE; O. Wiemer, St. Louis, Mo. App. filed May 17, 1909. A laminated transformer core consisting of separately formed crosspieces with their end edges in broken line and yoke segments registering therewith, thus avoiding waste in punching.

970,592. WIRELESS TRANSMISSION APPARATUS FOR CONTROLLING THE MOVEMENTS OF VESSELS; V. C. De Ybarrondo, Los Angeles, Cal. App. filed Jan. 31, 1910. Electromagnetic means combined with the rudder and energized by impulses transmitted thereto from the generating apparatus under control of the operator.

970,600. CIRCUIT CONTROLLING MECHANISM; W. A. Atwood, Schenectady, N. Y. App. filed Dec. 8, 1909. A gang of circuit breakers which may be tripped open and mounted side by side and interlocked. The movable member of the first circuit breaker actuates the latches so that the overload coil of each breaker need only be large enough to operate the latch of one breaker.

970,642. LIGHTNING CONDUCTOR; E. Redmond, Rochester, N. Y. App. filed Feb. 7, 1910. Consists of a metallic chain and a wire or strip passing at intervals through the links of the chain.

970,678. CLUSTER LAMP HOLDING DEVICE; R. B. Benjamin, Chicago, Ill. App. filed Aug. 5, 1907. Combines a supporting cap with a base and casing independently co-operating with the cap, the casing being detachably secured to the trap and the base aligned in the casing by the cap.

970,684. CONTROLLER HANDLE; F. E. Case, Schenectady, N. Y. App. filed March 30, 1910. A handle with means for stopping it in throwing off at the first "on position" during normal operation which may be made inoperative at the will of the operator.

970,693. GROUND CONNECTOR; J. L. Donald, Mooresville, N. C. App. filed Dec. 19, 1908. An integral metal collar pipe threaded on the inside and tapering to make electrical connection between the collar and the pipe and having a lug to receive the wire.

970,698. KEYHOLE ILLUMINATING DEVICE; C. Eyton, Los Angeles, Cal. App. filed June 2, 1910. A door lock with a keyhole and a hollow door knob with the battery and illuminating device in the knob controlled by a push button.

970,700. ELECTRIC FURNACE FOR TRANSFORMING PIG IRON INTO STEEL; G. Gin, Paris, France. App. filed Jan. 25, 1906. A hearth provided with a plurality of crucibles enclosing a plurality of elongated portions of the hearth and one or more electromagnets with cores near the elongated portions with oppositely wound coils on adjacent cores.

970,741. PANEL BOARD CUT-OUT AND DISTRIBUTING MECHANISM; R. H. Olley, Syracuse, N. Y. App. filed Dec. 13, 1909. A snap switch mechanism with a switch base of insulating material, having a cavity for receiving the switch and a series of recesses at the corners for receiving the conductors.

970,755. ELECTROPLATING; A. Rosenberg, London, England. App. filed March 16, 1909. Electroplates by making a dry mixture comprising a salt of the metal to be deposited and a second metal in powdered form, moistens the mixture and rubs it on the surface.

970,786. DYNAMO-ELECTRIC MACHINE; A. J. Brown, Norwood, Ohio. App. filed July 30, 1906. Collector rings having supports for centering them, including centering members with beveled surfaces carried by radial arms.

970,800. SIGNAL BOX; F. W. Cole, Newton, Mass. App. filed July 10, 1906. A sliding bar actuator mounted on the box door connected with a pivoted lever for engaging the winding arm and a breakable locking device for the sliding member.

970,820. APPARATUS FOR REPRODUCING PICTURES OR CHARACTERS; G. E. Hoglund, Chicago, Ill. App. filed Sept. 10, 1909. Improvements in the feeding mechanism for the instruments in the synchronizing mechanism and other parts of the machine.

970,821. AUTOMATIC EXCHANGE SELECTOR; H. B. Holmes, Park Ridge, and E. B. Craft, Wilmetter, Ill. App. filed June 4, 1906. A selector carrying the terminals of the line and having an arm sweeping over the terminals in long and short steps, respectively. A continuously rotating shaft controlled by an electromagnetic clutch controls the movement of the brush in long steps over the terminals and electromagnetic mechanism steps the brush in short steps over the terminals.

970,827. DYNAMO-ELECTRIC MACHINE; A. S. Hubbard, Belleville, N. J. App. filed July 3, 1908. A field for dynamos, including a plurality of radially arranged laminations having their inner ends in close proximity to each other so as to form a unipolar field.

970,850. WIRELESS TELEPHONY; A. Plisnier, Jr., Stuttgart, Germany. App. filed Feb. 12, 1908. The Duddell oscillating circuit is fed by a mercury vapor spark gap or an electric arc and the tension on the microphone may be varied by means of a self-induction coil, a shunt circuit including a microphone and capacity.

970,852. PROCESS OF AND MEANS FOR DEPOSITING METALS; A Rosenberg, London, England. App. filed March 16, 1909. A method of electroplating which consists in the application to an electrically conductive surface in the presence of an electrolyte of the metal to be deposited together with a polishing agent.

970,865. TROLLEY; G. Weber, Mount Oliver, Pa. App. filed June 17, 1909. Trolleys with a harp and a plurality of wheels, one or two of which always engage the wire.

970,869. INSULATED RAIL JOINT; E. C. Zimmermann, New York, N. Y. App. filed March 10, 1910. A rail member supporting a plate of conducting material insulated therefrom and a bolt connected with the plate and having a contact, but insulated from the rail.

970,886. FIRE AND POLICE TELEGRAPH SYSTEM; F. W. Cole, Newton, Mass. App. filed Sept. 27, 1907. A signal transmitter with a winding member, a pivoted lever therefor, and a lever secured to the pivot shaft thereof, and two independent actuators for engaging the lever to turn the pivot shaft and operate the actuating lever.

971,002.—Cover for Electrical Outlet Boxes.

970,887. FIRE-ALARM TELEGRAPH SYSTEM; F. W. Cole, Newton, Mass. App. filed April 25, 1908. A signal transmitter with a ground circuit connected with the main circuit by the operating device and rewinding mechanism to restore the operating device and disconnect the ground.

970,963. ELECTRIC SWITCH; F. W. Smith, New York, N. Y. App. filed April 19, 1910. A switch lever with terminal blocks on the panel, so that when the lever is locked it may be automatically released at the desired strength of current. Details.

970,975. PRIVATE BRANCH INTERCOMMUNICATING TELEPHONE SYSTEM; J. N. Wallace, La Crosse, Wis., and Edward B. Craft, Chicago, Ill. App. filed Nov. 23, 1907. Private branch exchange telephone system, including an intercommunicating system and also providing for outside connections with Central. Dispenses with the transfer key and makes use of contacts operated by the movement of the locking plates associated with a group of operating keys.

970,981. TROLLEY HARP; R. D. Blackstone, Muskogee Okla. App. filed Oct. 5, 1909. A pivoted arm carrying the wheel, pivoted to the end of the pole so as to follow the curve in the wire.

971,002. COVER FOR ELECTRICAL OUTLET BOXES; E. H. Freeman, Trenton, N. J. App. filed June 24, 1910. An outlet box with a cover plate. insulating bushings and a metallic cap plate.

971,006. ELECTRIC RAILROAD; G. P. Horton, Washington, D. C. App. filed Sept. 30, 1909. For transferring from an underground to an overhead system, the plow being hinged to throw it up out of the way when necessary.

971,010. ELECTRIC GAS-LIGHTING DEVICE; R. A. Jewett, Worcester, Mass. App. filed July 2, 1907. When the valve controlling the gas supply is turned it also ignites the gas passing from the burner. Details.